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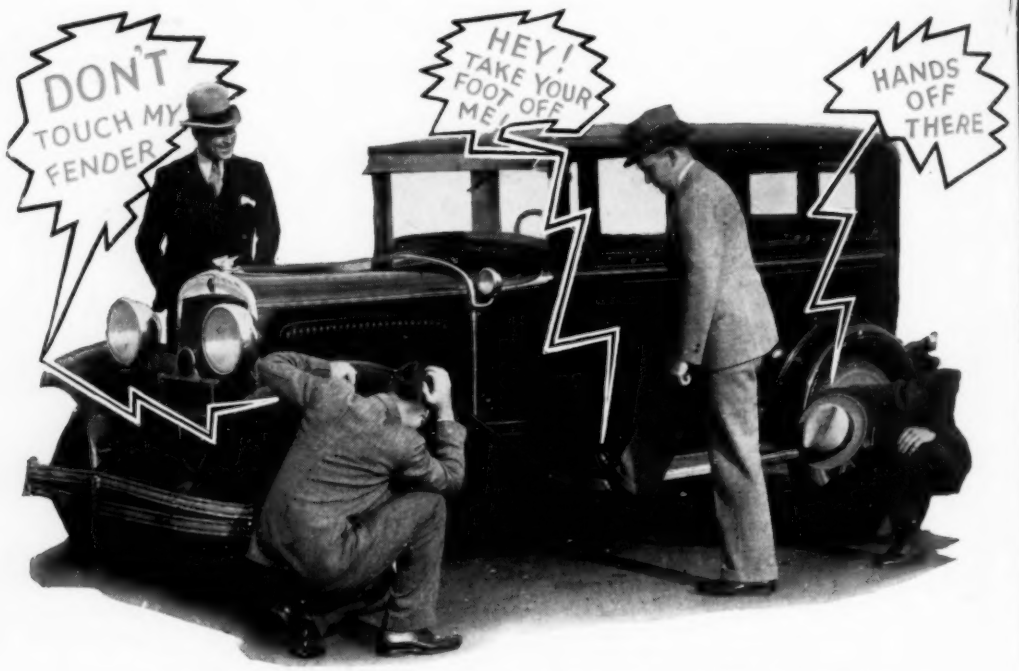

Uncanny Invention Startles Motorists

Protects Your Car From Thieves, Puzzles Your Friends!

Here is something incredibly new and revolutionary. More mysterious than anything since the first discoveries of radio! As uncanny as electricity itself! Actually more useful and valuable than the self-starter on your car! As easily controlled as your headlights! Inexpensive! No wonder it has turned the motor world topsy-turvy overnight!

Pays Agent Record Earnings Of $138 In A Day!

IMAGINE having a car that no sneak thief can tamper with! No joy-rider can steal! No friend can touch without being warned to keep away! Then think of offering this uncanny electrical device to other motorists at a price scarcely greater than the cost of a new radio tube!

In the above few words you have the reason why G. Oliver of Illinois set a profit record of $138 in a single day. James Harper of London, England, cables, "Devil-Dogs received, ship immediately three hundred, cable best terms for sales concession, Great Britain." A. Karratti of Hawaii writes, "Have equipped my car with Devil-Dog and am creating a sensation." Ernest Flom, No. Dakota, states, "The Police force praise it highly." Richard Jacques, Canada, writes, "Have sold one for Police armored car and am getting letters from Chief of Police and Detective Departments. What these men say is just an indication of what motorists everywhere are saying. No wonder our agents are making money hand over fist, both spare time and full time.

A Mere Handful

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Send Quick For 5 Day Test

This astounding invention fits any car from a Ford to a Rolls-Royce without adjustment or fussing. It can be installed by anyone in ten minutes or less. There is no cost for operation. No extra batteries to buy. An introductory offer now lets you examine the most spectacular invention since the radio first came in, on 5-day test. Profit possibilities as our agent are almost unlimited. Mail the coupon for 5-day offer and complete territory details. No obligation whatever, but do it now!

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Northwest Electric Corp., Dept. D-10, Pukwana, S. Dak.
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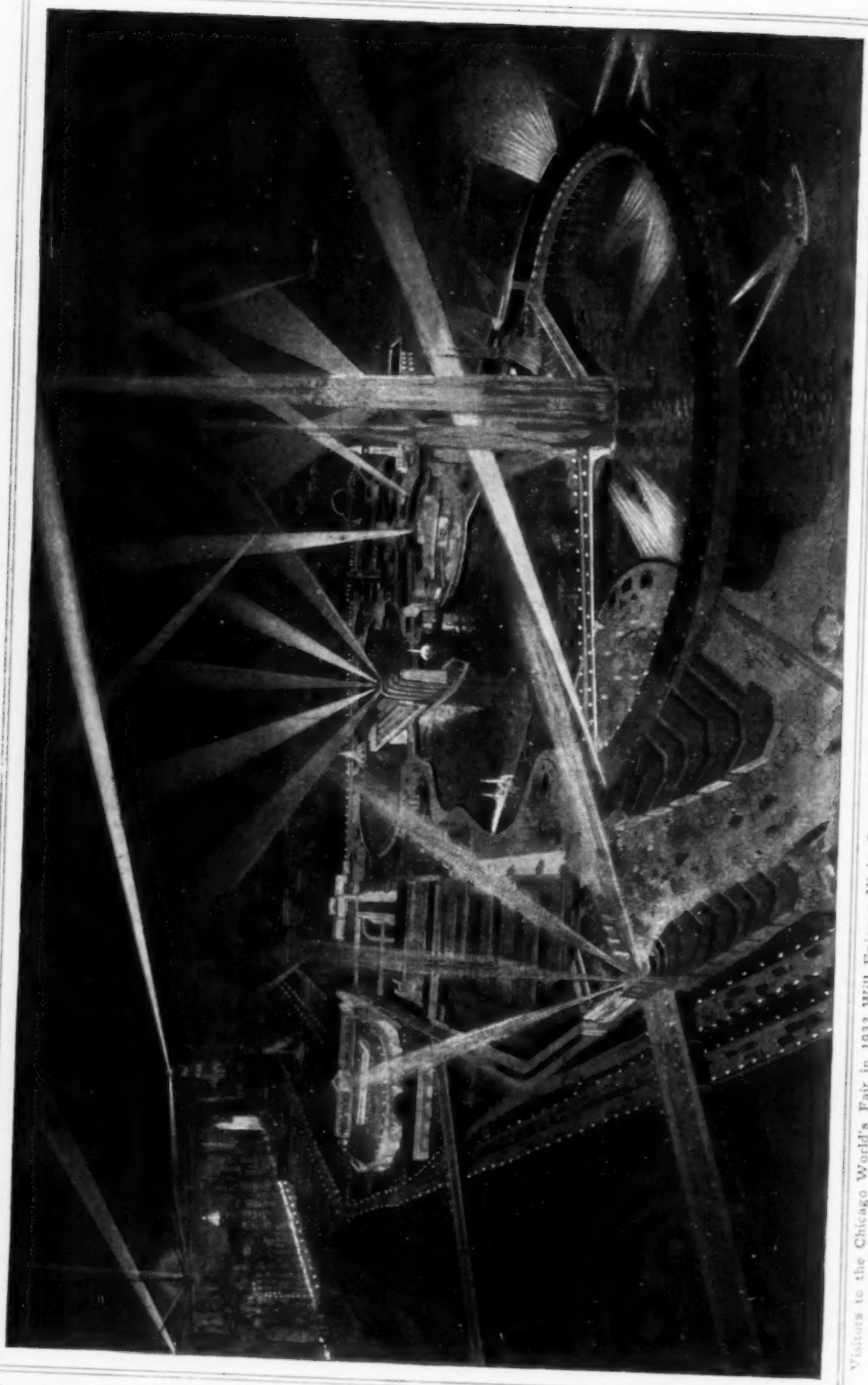

Visitors to the Chicago World's Fair in 1933 Will Enjoy a Night Scene Somewhat Like That Above; It Shows Some of the Buildings to Be Constructed on the Lake Front, Together with the Contemplated Lighting Effects; Models of the Structures Were Used in Composing the Picture

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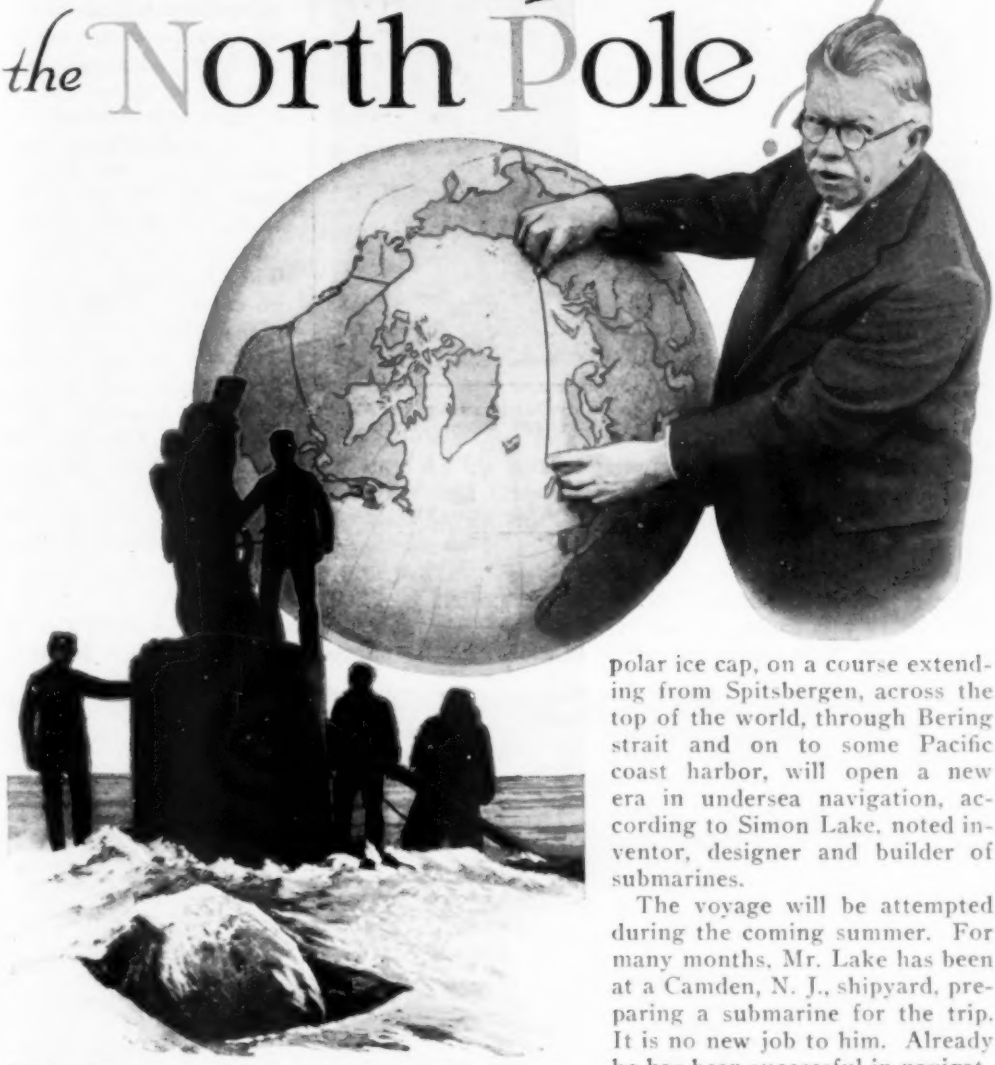
To Europe via the North Pole



Conning Tower of Sub Emerging through Ice, and Simon Lake, Showing One Trade Route He Expects to Open

THE SUCCESSFUL completion of the first submarine cruise beneath the polar ice cap, on a course extending from Spitsbergen, across the top of the world, through Bering strait and on to some Pacific coast harbor, will open a new era in undersea navigation, according to Simon Lake, noted inventor, designer and builder of submarines.

The voyage will be attempted during the coming summer. For many months, Mr. Lake has been at a Camden, N. J., shipyard, preparing a submarine for the trip. It is no new job to him. Already he has been successful in navigating an undersea craft beneath fields of thick ice. In his little submarine, the "Defender," fitted with ice-breaking devices, he has demonstrated

Visitors to the Chicago World's Fair in 1933 Will Enjoy a Night Scene Somewhat Like That Above: It Shows Some of the Buildings to Be Constructed on the Lake Front, Together with the Contemplated Lighting Effects; Models of the Structures Were Used in Composing the Picture

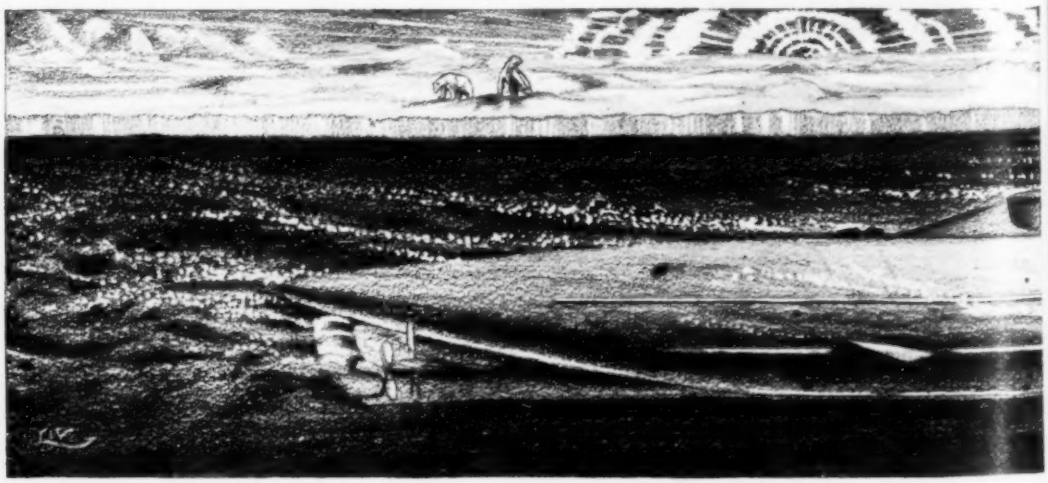
A Small Submarine Returning to Harbor after Demonstrating Its Ability to Break through Fields of Ice by Rising from Beneath Them

the ability of the craft to submerge, take position under a heavy field of ice and by its buoyancy smash through to the surface.

True, these excursions under the ice were of very brief duration compared with the Spitsbergen to Bering sea voyage, but the veteran submarine builder is of the unqualified opinion that the arctic trip will be a success from start to finish. Furthermore, he declares, it will be of the greatest importance to shipping interests the world over. In fact, he deems it so important that he has already prepared complete working plans for a big cargo-carrying submarine, and is ready to start its construction.

This new submarine is a real colossus as compared with any heretofore built. Fighting submarines average well under 200 feet in length. The giant undersea cargo carrier, the "Deutschland," that in the early days of the world war made successful voyages between Germany and the United States, was 315 feet in length and had a beam of thirty feet, with cargo capacity of about a thousand tons. The new Lake submarine will have a length of 395 feet, a beam of fifty-six feet and will be capable of carrying a load of 7,500 tons.

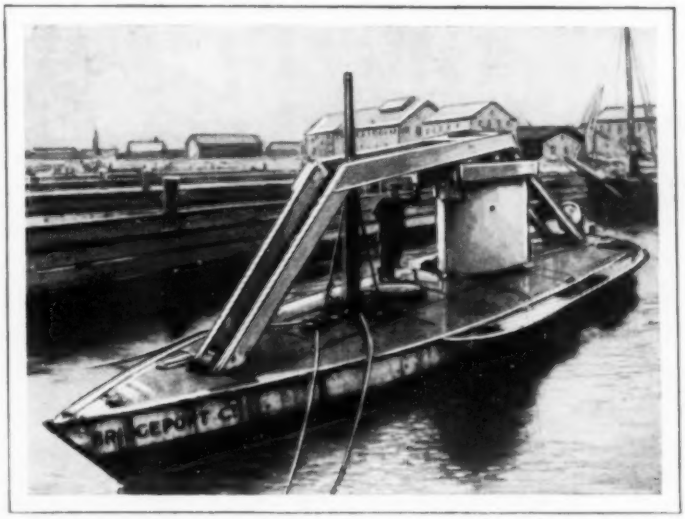
"There is a real place for such a craft in the shipping of the world," declared



A Giant Cargo Submarine Which Is Intended to Carry Freight to Europe by Taking the Short Route through the Arctic Ocean, Making the Trip under the Ice

Mr. Lake in an exclusive interview for Popular Mechanics Magazine. "The cargo-carrying submarine will afford a vehicle for shortening many world shipping routes and lessening of elapsed time between the port of loading and the port of unloading.

The supreme directness of these submarine routes proposed by Mr. Lake cannot be appreciated by study of an ordinary flat map, which distorts distances and even directions. Tracing them out on a globe, however, makes the matter clear.

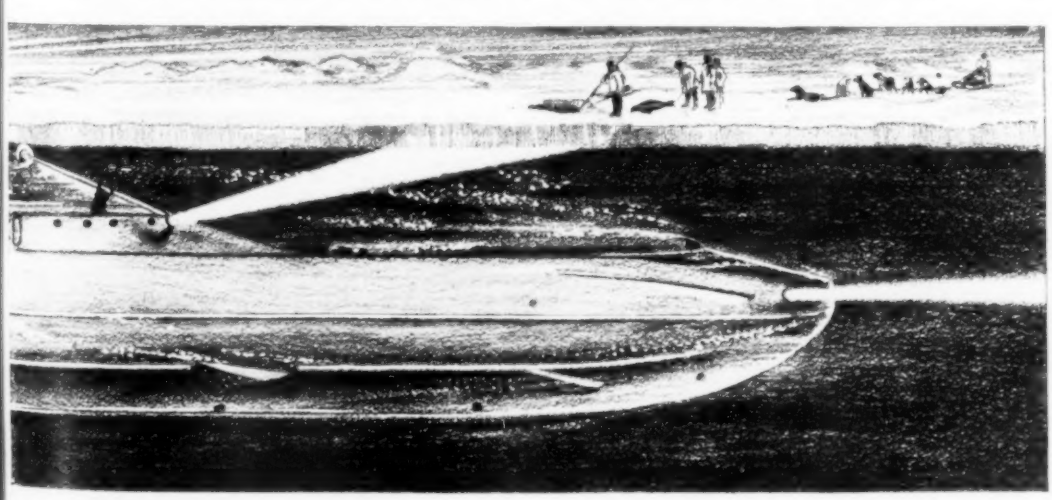


A Small Submarine Fitted with an Ice-Breaking Attachment, Enabling It to Rise under the Ice and Force Its Way Up

"Let's take a look at these routes," suggested Mr. Lake, stepping to the globe. "The distance from Liverpool to Yokohama by way of the Panama canal is a little over 13,000 miles. That's the shortest route available to a surface vessel. A submarine, capable of cruising beneath the ice, finds this roundabout path replaced by an absolutely straight course—the one up through the Arctic ocean. The distance from Liverpool to Yokohama, via the north pole, is 5,800 miles, a saving of more than half the mileage. Going from Liverpool to Seattle by the latter route would mean a saving of about 4,000 miles over the Panama canal route.

"A submarine can cruise as rapidly as the ordinary cargo surface craft. Furthermore, lying low in the water, its progress will be little retarded by head winds. In the event of encountering heavy gales, the undersea craft can submerge and proceed in the calmness of the lower waters.

"The submarine capable of cruising the arctic seas will open up vast storehouses of natural wealth, at present unreachable. North of the arctic circle, close by the mouth of the Mackenzie river are great de-



The Diagonal Attachment, Like a Street-Car Trolley Pole, Is Intended to Protect the Submarine from the Ice; the Boat Also Would Carry Ice-Breaking Attachments

Above, Sealing Vessel Caught in Ice, a Fate the Submarine Would Avoid by Traveling under the Floe; Right, German Submarine That Brought Load of Dyestuffs to America during World War

posits of copper ore so rich that one may pick the virgin metal out of the seams. Besides copper, the same district has huge deposits of high-quality coal and petroleum. The submarine will make them available.

"Then, consider Siberia. There's a wondrous store of wealth locked up in her inaccessible expanse. Under present conditions, the expense of getting out her gold, silver and base metals and the great crops of grain that could be raised on her fields with their twenty feet of rich, black loam, would take all the profit out of the operation. However, five great rivers, open to navigation for several months of the year, lead from the interior to points on the Arctic ocean coast. River boats could bring this vast store of wealth down to ports established at the river mouths. These harbors are ice-bound the year round, but a cargo submarine could reach them at any season.

"The testimony of polar explorers proves the practicability of navigation beneath the arctic ice. Their evidence is that there are no bergs in the great ice cap, to form an impediment beneath the surface; glaciers are necessary for the formation of ice bergs and glaciers form on land. No land has as yet been discovered in the polar district.

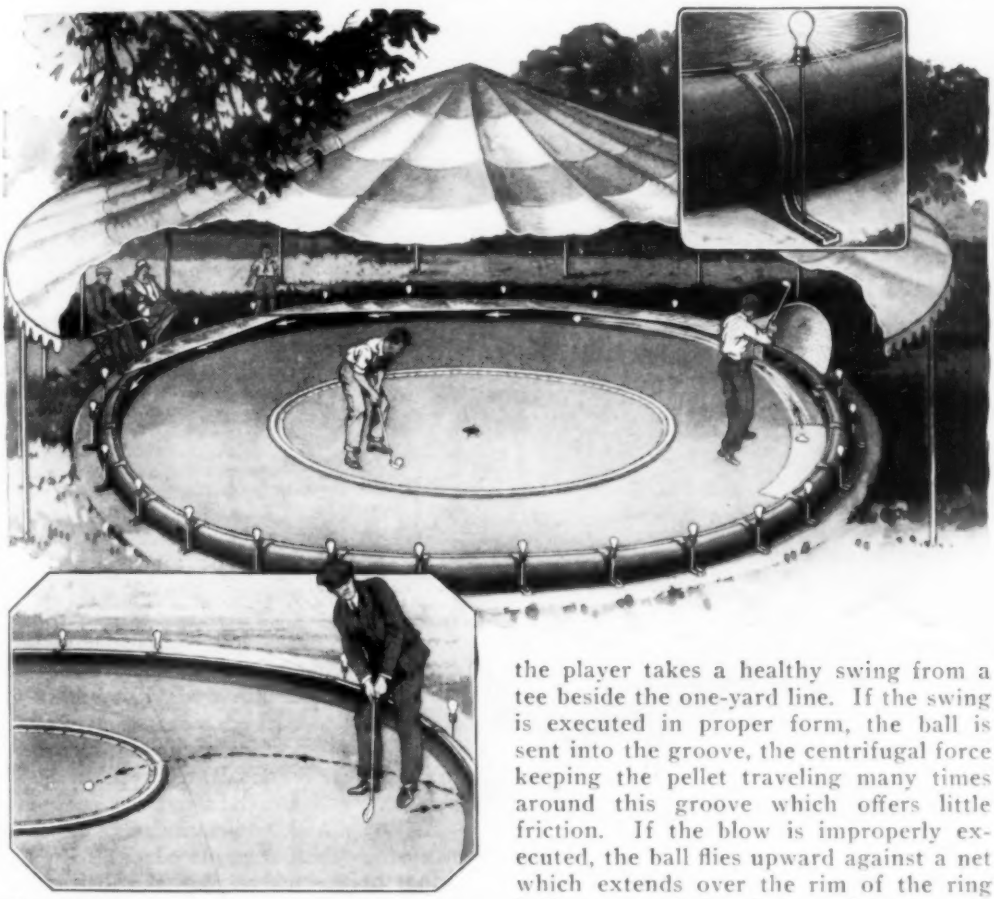
"Both those who have traversed the ice cap with dog teams and those who have flown above it, declare that there are many open leads of water at intervals throughout the flow. This is another factor in favor of submarine navigation of the route. A submarine cannot cruise indefinitely beneath the surface; the craft must have access to the open air at intervals so that the engines may be run to recharge the batteries that give power when cruising below.

"However, even if no open leads are encountered, a properly equipped submarine will have no difficulty in recharging her batteries. In the Gulf of Finland, I demonstrated the use of an ice-boring machine attached to the deck of the submarine and operated from the interior. There was no difficulty in boring upward through some twelve feet of solid ice, running up an air-intake pipe and operating the engines, with the craft several feet below the surface.

"The cargo submarine designed for under-ice navigation will, of course, be equipped with an ice borer. The upper part of the hull will carry a device of proved practicability for smashing through fields of light ice.

"It is my prediction that a direct outcome of next summer's cruise from Spitsbergen to Bering sea, will be opening of the northwest passage to regular traffic."

ALL THRILLS OF GOLF IN TWENTY-FIVE-FOOT RING



How a 300-Foot Drive and Many Other Shots Are Possible on a Twenty-Five-Foot Circular Golf Course Surrounded by a Concave Ring in Which Ball Travels

All the thrills, hazards, difficulties and shots that are possible on a real golf course are contained within the space of a twenty-five-foot circle in the latest variation of the miniature course. The course, however, is miniature only in the sense that it occupies a small extent of space and can be set up on the lawn or in a large room, for it offers virtually every kind of stroke that can be made on any fairway, from 300-yard drives to exasperating bank and chip shots. The secret of making a 300-yard drive within the restrictions of a twenty-five-foot circle lies in the construction of the frame. The cast-iron ring, about a foot high, is molded in a deep concave shape. It is in this grooved circle that the ball travels when the player takes a healthy swing from a tee beside the one-yard line. If the swing is executed in proper form, the ball is sent into the groove, the centrifugal force keeping the pellet traveling many times around this groove which offers little friction. If the blow is improperly executed, the ball flies upward against a net which extends over the rim of the ring halfway round the circle, and its force is wasted. The ring is marked in yards, one trip around its circumference representing twenty-five yards, so the yardage for each stroke is quickly estimated when the ball stops. The cup is in the center of the circle, but at a distance of six feet from it is a ring of cotton hose, folded so its outer edge presents an effective trap for the ball at every point. The only way of reaching the green is by employing bank or chip shots. Execution of a successful bank shot is difficult, even for the expert golfer, because the bank must be made against the concave surface of the outer ring, and unless the angle is calculated with exactness, the ball is almost certain to fall short or overshoot the green. Once on the green, there still remains the possibility that a six-foot putt will be necessary to hole out.

BOAT SPEEDS MORE THAN HUNDRED MILES AN HOUR

Photos by Planet News, Ltd.

Two Views of the Speedboat "Miss England II," in Which Kaye Don Recently Broke the World's Speed Record

Driven by Kaye Don, British racer, the speedboat "Miss England II" attained a speed of more than 107 miles an hour to set up a new world's record during recent tests on Loch Neagh, near Belfast, Ireland. A pace of 110 miles an hour was not officially recognized during the trials. This is the craft in which the late Sir Henry Segrave, British automobile racer, was killed when it capsized in Lake Windermere. Since that accident it was overhauled and repaired for a race at Buenos Aires, in which Don also will act as the pilot.

INCREASE IN AIR PASSENGERS CARRIED BY U. S. PLANES

American air-transport lines in 1930 carried 385,910 passengers, an increase of 133 per cent over 1929. Thirty-four major lines, according to a survey of the aeronautical chamber of commerce, were operated regularly over more than 50,000 miles of airways in the United States, southern Canada and a score of Latin-American countries. These lines flew 28,833,967 miles, a forty-two-per-cent increase over 1929. There was a marked increase in safety, only one fatality being recorded for every 3,900,000 passenger-miles. Less than seven per cent of the 53,000 scheduled trips were canceled or not completed, bad flying weather accounting for nearly all incompleted trips. A few trips were canceled because of insufficient traffic, but mechanical difficulties accounted for only a minute fraction of the trouble. More than 8,000,000 pounds of air mail were carried, an increase of about 1,000,000 pounds.

GIGANTIC BRIDGE SPAN LIFTED BY PULLEY-BLOCK METHOD

Lifting a heavy load in a warehouse is accomplished simply by hanging a pulley block from the ceiling, attaching another to the load, and hauling on a rope passing through the pulleys. The same principle was recently employed by engineers faced with the job of lifting two spans of a steel-truss bridge, each 139 feet long and weighing forty-five tons. The problem arose when it was found that, because of a new dam, a bridge near Stanwood,

Mich., would have to stand twenty-nine feet above the mean water level which required lifting the spans twenty-one feet to concrete abutments, one at each side of the stream and one in the center. Steel columns and crossbars were mounted on the foundations and pulley blocks were suspended. Each span was raised separately by rigging pulley blocks at each corner, the upper block attached to the temporary frame and the lower lashed to the lowest part of the bridge structure. Cables, passing through each set of blocks in a six-part line, were pulled by two two-drum hoists, one on each side of the river, and the use of six-part lines on each of four corners, thus making the load actually lifted by each drum of each hoist a little less than two tons. Each corner was raised four inches at a time, and the first span was lifted in less than three hours, the second one requiring even less time.

AIRPLANE FOLDS INTO TUBE TO FIT SUBMARINE

Successful test flights have been made by the navy with a collapsible seaplane that can be taken apart and folded into a tube in three minutes for carrying on a submarine. It has a wing span of thirty-one feet, a length of forty-nine feet and develops a speed of approximately 100 miles an hour. The wings do not fold but are easily and quickly detached. The engine drives a pusher propeller and folds down upon the fuselage. Wings and propeller are constructed to fit into a tank turret on the submarine, while the folding fuselage fits into a larger tank.

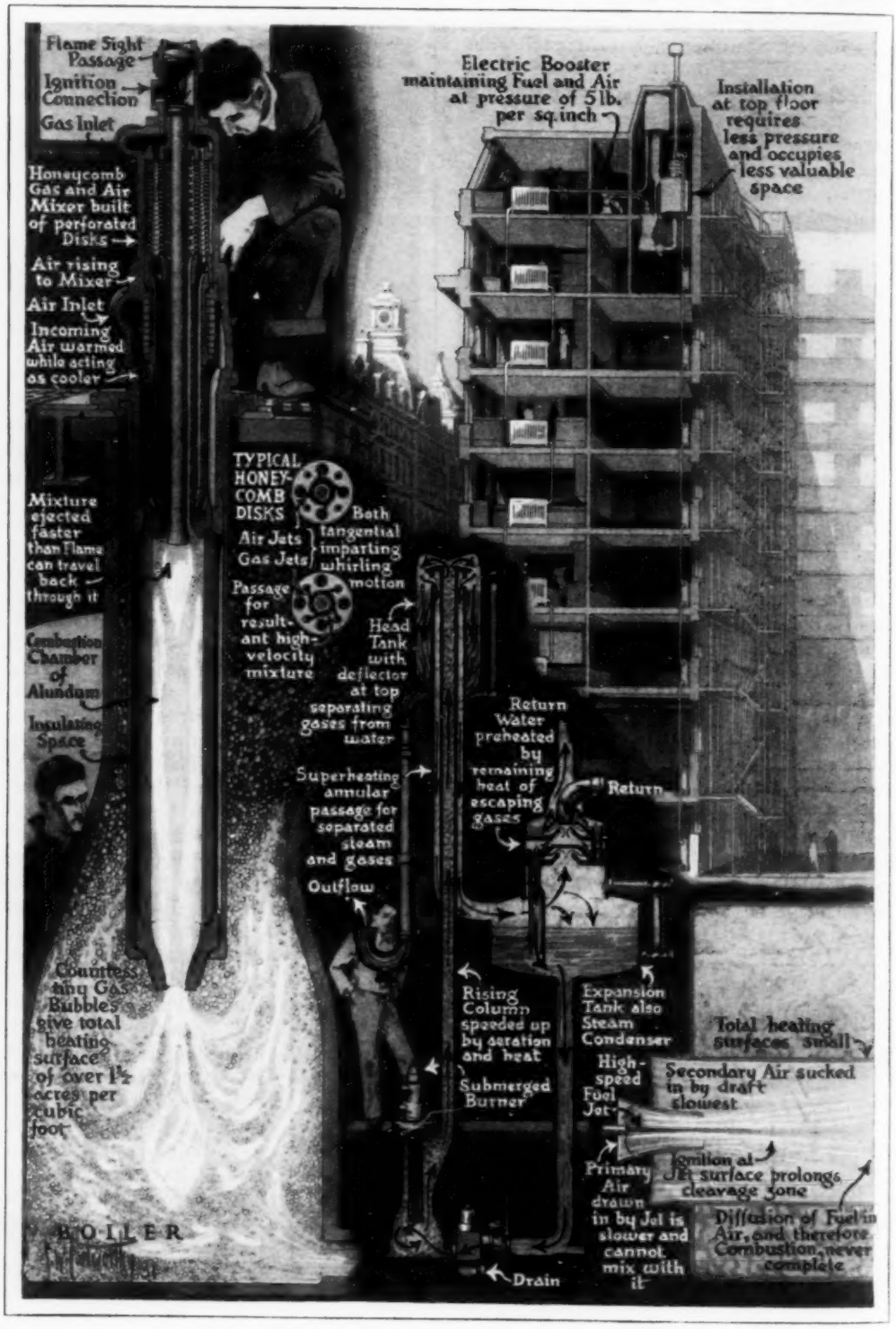
Collapsible Airplane That Can Be Taken Apart and Folded into a Tube in Three Minutes for Carrying in a Submarine

BETTER INSULATION IS FOUND FOR ELECTRIC WIRES

Preparing to Apply Solventless Varnish Insulation to Electric Equipment in Container

Successful tests recently have been concluded by the Westinghouse Electric and Manufacturing company with a solventless varnish insulation for electric wires that is expected to save the electrical industry over $1,000,000 a year. The insulation provides a new method of forcing electricity to follow a prescribed path, and is applicable to virtually every field of the industry from tiny clock motors to electrical giants. The varnish completely fills the pores of the fibrous material between the wires, becoming an integral part of the electrical apparatus. The varnish is placed in a container, heated to make it flow freely, and the object to be insulated is placed in a second container and the lid is clamped down. The air inside is removed to form a high vacuum and pressure is applied, after which the varnish is drawn from the first container into the second, until the object is submerged. Apparatus so treated have no hot spots such as develop in ordinary impregnating materials where air holes are likely to form, making the insulation poor.

SUBMERGED FLAME MIXED WITH WATER IN BOILER


Flame Sight Passage
Ignition Connection
Gas Inlet
Honeycomb Gas and Air Mixer built of perforated Disks
Air rising to Mixer
Air Inlet
Incoming Air warmed while acting as cooler
Mixture ejected faster than Flame can travel back through it
Combustion Chamber of Alundum
Insulating Space
Countless tiny Gas Bubbles give total heating surface of over 1½ acres per cubic foot
BOILER
Electric Booster maintaining Fuel and Air at pressure of 5 lb. per sq. inch
Installation at top floor requires less pressure and occupies less valuable space
TYPICAL HONEY-COMB DISKS
Air Jets
Gas Jets
Both tangential imparting whirling motion
Passage for resultant high-velocity mixture
Head Tank with deflector at top separating gases from water
Superheating annular passage for separated steam and gases
Outflow
Return Water preheated by remaining heat of escaping gases
Return
Rising Column speeded up by aeration and heat
Submerged Burner
Expansion Tank also Steam Condenser
Total heating surfaces small
High-speed Fuel Jet
Secondary Air sucked in by draft slowest
Primary Air drawn in by Jet is slower and cannot mix with it
Ignition at Jet surface prolongs cleavage zone
Diffusion of Fuel in Air, and therefore Combustion, never complete
Drain

Drawing by J. W. Clatworthy

FLAME BURNING UNDER WATER FOUND MORE EFFICIENT

For heating boilers, a remarkable system of submerged combustion, in which the flame, burning under water, is applied directly to the liquid, has been tried successfully in England in actual heating installations. This system differs radically from an earlier process wherein the flame of an oxyacetylene torch burned in a space blown clear of water by compressed air. The latest flame is intimately mixed with the water itself, a honeycomb device, through which gas and air pass, insuring a perfect mixture of the two in order to achieve virtually complete combustion in the boiler. The method is based on the fact that the flame is generated faster than it can be dispersed and is therefore unquenchable. The speed of the flame in the combustion chamber reaches 300 feet a second. It is in the enormously increased efficiency that submerged combustion scores over the ordinary plant, shown on the opposite page at the lower right, due to the great total heating surface provided by countless bubbles, as compared with the usual furnace sides. These gas bubbles give a heating surface of over one and one-half acres per cubic foot. At the upper right in the drawing is shown an actual installation with automatic push-button control.

FOLDING FACE MIRROR SHOWS SIDES AS WELL AS FRONT

Two facing mirrors are joined together by a hinged handle so that when they are opened, they show the front and sides of the face, and may be adjusted to obtain a view of the back of the head as well. The outer covering of the mirror is a durable substance resembling mother of pearl, and since the glasses fold together, they are protected from dust and from being scratched.

He Looks Like a Mechanical Man, but the Robot Figure Only Calls Attention to a Sheet-Metal Shop

ROBOT OF SHEET-METAL PIPE ADVERTISES SHOP

Taking advantage of the vogue in robots, or mechanical men, for advertising purposes, a California sheet-metal dealer constructed a realistic replica to attract attention to his wares. The figure, which cost but a few dollars, was placed in a conspicuous position outside the store and was made more effective by using bright paint for the face markings.

ELECTRIC EYE WATCHES STAR TO GIVE ACCURATE TIME

To give an absolute check for setting the clock, a photo-electric cell, or electric eye, is used to record with utmost accuracy the passage of a star over a given meridian. For this purpose, the cell is placed behind the collimator slit of an astronomical telescope, a hair line being focused at the middle of the slit. When the image of the star comes upon one edge of the opening, the light passing the edge is used to produce a musical note in an auxiliary device connected to the cell. When the star coincides exactly with the hair line, the light and also the musical note are interrupted. Simultaneously a photographic record of the transit is made.

Outboard-Motor Boat Equipped with Power Blower Used to Dust Mosquito-Infested Waters

POWER FAN KILLS MOSQUITOES BY BLOWING POISON DUST

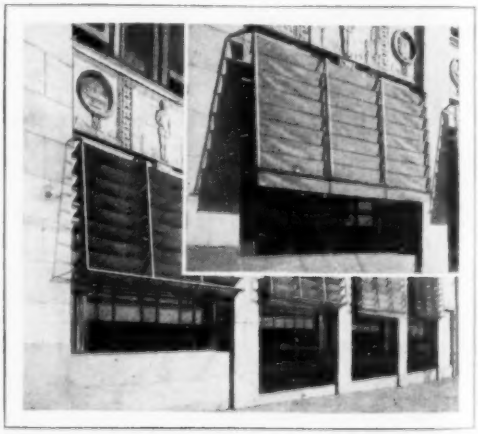
Portable power fans, installed on outboard-motor boats, are being used with much success in mosquito extermination in some areas. The boat is propelled in mosquito-infested waters, and the fan dusts the area with Paris green and powdered lime. Only one man is needed to operate both boat and fan, the latter being gasoline-driven. The nozzle capacity of the blower is 1,500 cubic feet a minute, and the dust emitted is effective for more than 500 feet. In other sections, natural enemies of mosquitoes, birds, fish, lizards bats and frogs are being enlisted against them. The greatest known destroyer of mosquito larvæ is the dragonfly, but bladderwort, a plant that lives in the marshes, also traps large numbers of them, and some kinds of minnows have been known to eat fifty-six times their weight of larvæ in an hour. Bats will often consume 1,000 mosquitoes in a night. The cannibal, or French, mosquito has a great antipathy for humans, but feeds on the mosquito that does annoy humans.

POWER-PLANT CAPACITY TOLD BY WEATHER OBSERVERS

Weather observers foretell other things besides tomorrow's rain or shine. Several of them are regularly engaged in forecasting the daily capacity of the Conowingo hydroelectric plant on the Susquehanna river. This power project differs from most installations because at certain periods of the year, during low water, it serves as an auxiliary to the steam plants of a Philadelphia electric company, while during high water, the steam plants are auxiliary to it, neither being large enough to carry the entire load alone. It therefore is necessary to approximate the amount of electricity the hydroelectric plant can supply at all times. For this purpose weather observers are stationed along the river at fixed points. They keep accurate check on rainfall and the condition of the river, wiring the information to a central base.

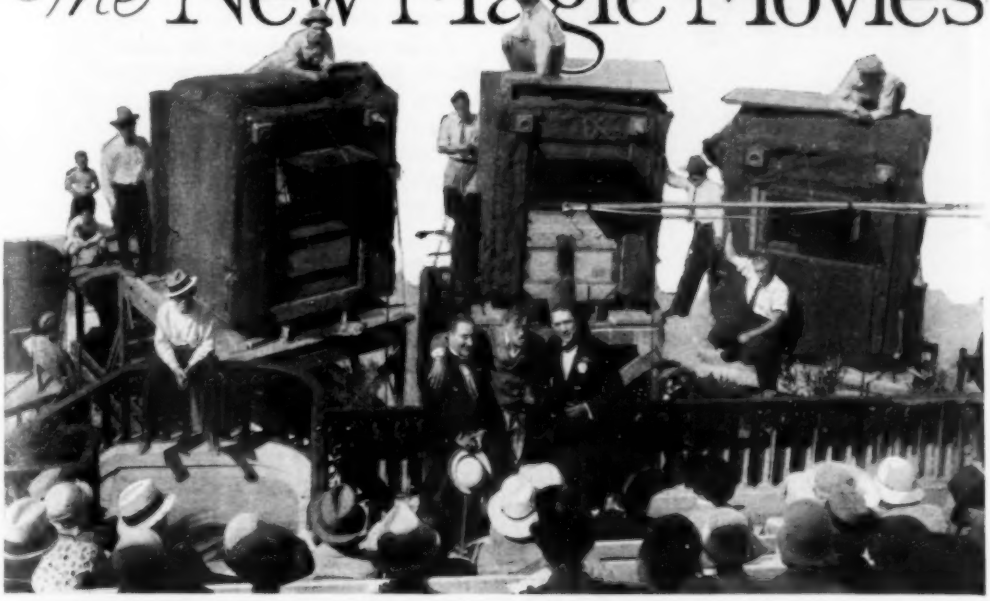
LOUVER-TYPE WINDOW AWNING PROMOTES ROOM COMFORT

Better circulation of air, reduction of fire hazard and greater beauty are among the advantages claimed for louver-type window awnings recently introduced. Since they can easily be adjusted to various angles, they admit light and air while excluding the sun, and the openings prevent the gathering of dirt and the lodging of cigar or cigaret stubs, a frequent cause of fires on usual awnings.



Louver-Type Awnings in Various Positions, for Admitting Air and Preventing Accumulation of Dirt

The New Magic Movies



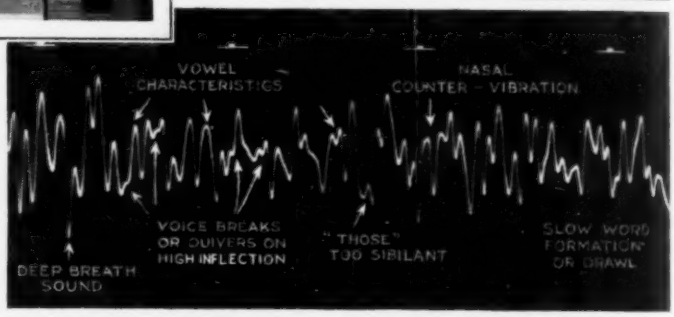
© Western Electric Co.
Director Lloyd Bacon Telling a Mob of Extras How to Register Action for a Color Comedy; Note Soundproof Shields around Cameras and Apparatus at Rear

IN THE LAST twelvemonth, movie realism has grown in every dimension. All the world moves across a screen, and the players thereon are electrons. In the movies, science has for the first time vitalized and strengthened an art.

Shadows now talk with the fidelity of men and women in the flesh. The latest method of recording and reproducing brings the greatest single advance to this technique in the past four years. A product of the west-coast laboratories of the Electrical Research Products, Inc., the new process of noiseless recording will soon be used by 7,500 theaters. It is the answer of sound engineers to the public's criticism of ground noises, static, scratching and "noisy" silence.

Before these problems were attacked, recorded sounds extended only from about 200 cycles per second, in the lower ranges, up to 4,000 at the higher ranges. This kind of reproduction gave reasonable clarity to the spoken word, but faithful musical reproduction was impossible because one could hear none of the bass or shrill frequencies. The once-familiar lisp in the movie voice was caused by the absence of higher frequencies. Pictures in production at the present time, therefore, have their sound sequences recorded in a greatly extended range of frequencies: from sixty cycles at the low end, to 6,000 cycles at the high end. What now is sought is a low-range goal of thirty cycles and high-range goal of 10,000 cycles. The human ear's reception extends between twenty and 14,000 cycles per second; that is, the maximum range possible with highly sensitive eardrums. If you lose the high, shrill voice of the violin, the cello bass, and the full range of the piano, the human ear senses at once the lack of "musical personality" or timbre.

As a receiving apparatus, the ear is extraordinarily efficient. It cannot be deceived so readily as the eye. It hears the equivalent of nine and one-half octaves, that is, from the lowest rumbles of pipe organs to the high jingle of keys. And as regards loudness, the ear is sensitive to the rustle of leaves and the thunder of artillery. The ratio of volume between these noises is as 1 to 100,000,000. The ear detects a change of only three-thousandths in an octave.



Strip of Talking Film Showing Sound Track, and Vibration Study of the Voice of Anita Page

Better to understand the problem, the Bell Telephone Laboratories devised a "sound filter" or sound analyzer.

This instrument has the ability to distinguish and separate the different frequencies making up a given sound. The human voice is made up of sounds ranging from fairly low to a high pitch. The electric filter can quench any frequency in the voice, so that, when it is reproduced, we have a sound that is free from either high or low tones. If the filter is made to cut out high pitches, the voice sounds low and guttural, and hardly understandable. All sibilants, such as the letter "s," are dropped and the speaker sounds as if he were lisping. Quenching the low notes makes the male voice sound effeminate and screechy.

Theater acoustics are another factor which determines timbre and sound-frequency range. The problem, therefore, is to quench a sound before it echoes, but not to stifle resonance. The average speaker utters three words per second, and if a theater's acoustics are such that each word persists five seconds, you have fifteen words flying about simultaneously, and the ear is in agony. The amount of absorption in the walls determines how long a sound will persist. Rugs, clothes, curtains, upholstery and, recently, acoustic cells, may be used to quench a vibration or echo.

Each theater provides the sound engineer with its own peculiarities. Recently one was asked to investigate why talking-picture reproduction is better in winter than in summer. His answer was that winter clothing absorbed more sound than summer clothing.

A Broadway showman asked the engineer to determine why reproduction was better in the afternoon than in the evening. And the answer was that starched shirt fronts on the men deflected the sound waves and caused a slight echo.

A crew of four sound engineers were assigned to diagnose and eliminate the hum in the sound equipment of a New York theater. They began work after the theater closed, near midnight. A 1,000-foot reel of tested film was run through the projector. The hum persisted. An analysis revealed at once that the outside current was impure. All night they tried to eliminate noise by hitching on condensers. Dawn came, and still no results. At length, one decided to walk around the block for a breath of air. Thus he discovered that the block housed a power station that had been tampering with the voltage of the theater current. A special condenser eliminated that interference.

The new-process noiseless recording has solved some of the sound engineer's most pressing problems. He has cut mechanical and artificial noises to a point where nothing save refinement is necessary to bring the system to absolute perfection.

In the early days of sound pictures, the monitor man, or mixer, sat in a separate soundproof room and judged the quality of the sound. Soon the portable monitor room was developed. But now the mon-

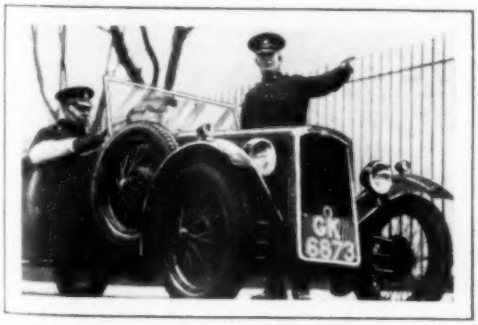
tor may walk about with his head insulated against all noises except those that come to him through a set of earmuffs.

To measure the development of film, a new "sensiometer" and "densiometer" have been introduced. A new system of reproducing sound on a disk has been perfected. It engraves an up-and-down groove, the "hill-and-dale," instead of the old "lateral cut." Hill and dale permit a closer spacing of the groove, so that a twelve-inch disk will run as long as a sixteen-inch disk of the old type.

In order to take "fading"—the matter of controlling volume—out of the hands of the projection operator, ERPI has invented a "dubbing" machine. The average 8,000-foot picture is made up from about 200,000 feet of negative, expertly cut and assembled. Naturally, the tone and quality of sounds in different scenes do not run into each other with pleasant transition. The dubbing machine makes possible the re-recording of the film under controlled conditions, so that the producer or director, and not the projectionist, can lay the exact emphasis on both voices and music. The sound quality is not marred by distortion. In dubbing, sound effects can also be added, such as instrumental music and artificial noises. This is a highly specialized art.

THREE-WHEELED POLICE AUTOS DODGE HEAVY TRAFFIC

Small three-wheeled automobiles are being used by squads of London police to speed through dense traffic. The cars are sturdily constructed, and their distinctive appearance helps identify them and keep other drivers out of the way.



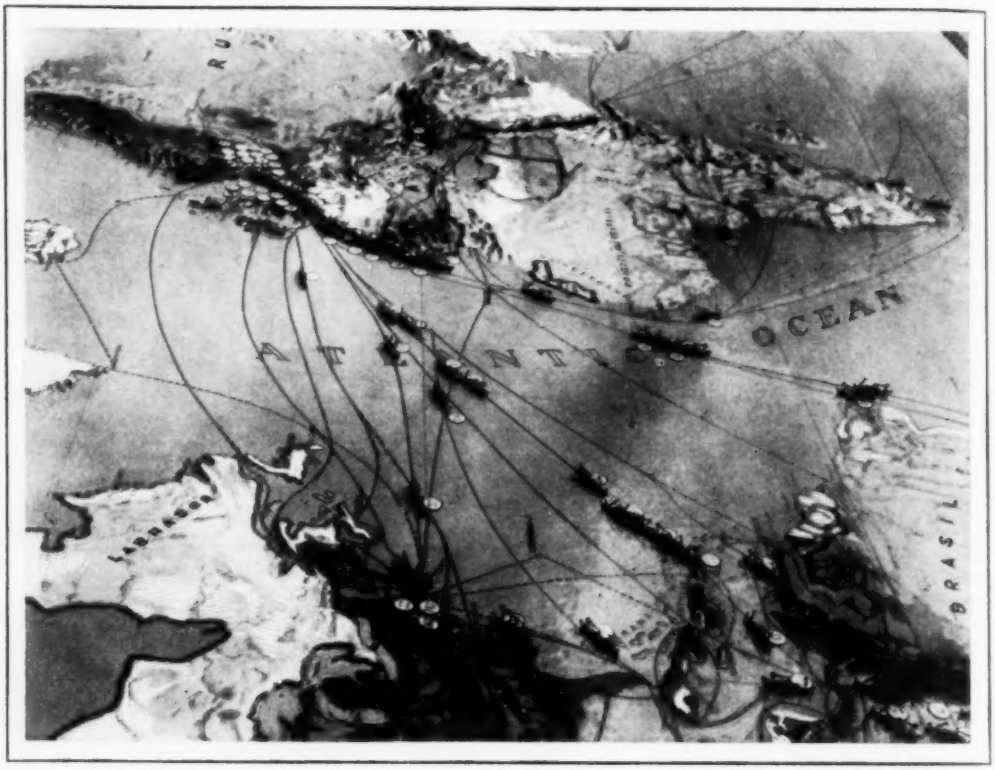
Three-Wheeled Auto Employed by London Police to Make Better Time in Heavy Traffic

FOOT-OPERATED BANK ALARM WORKS AUTOMATICALLY

Foot-Operated Bank Alarm Which Rings Continuously When the Pedal Bar Is Moved Upward

To provide a continuous alarm in case of a bank holdup, a foot-operated system has been devised that, once started, keeps on ringing until it is switched off. Many foot-alarm systems depend for operation on the pressing of a contact button. When this is released, the alarm no longer functions. Bank bandits have learned this, and often warn tellers and cashiers away from counters or cages so they have no opportunity to operate the alarm. The latest warning is operated by a bar under the teller's desk. This bar is lifted up with the toe. This action makes a contact with switches which start the alarm ringing and at the same time cause swinging legs on the crossbar to assume a vertical position, thus keeping the alarm switches in contact. The device then operates automatically until the bar is released and pushed down. The upward movement for contact makes it less likely that the alarm will be set off accidentally.

PATHS OF SHIPS ARE SHOWN IN MINIATURE OCEAN



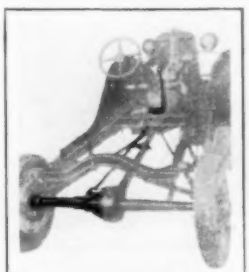
Map of Miniature Ocean with Lanes Indicated by Lines and the Position of Ships by Numbers; the Map Is an Aid to Passengers in Getting Their Bearings on a Voyage

Passengers on ocean liners often have difficulty in getting their bearings unless they are familiar with latitude and longitude readings and meanings. To assist them in determining their position at sea easily, some German vessels are provided with maps in the form of miniature oceans with the steamship lanes all plainly marked. Numbered markers show the position of various ships on the lanes, these markers being shifted daily as the vessels proceed.

ELEVATED POWER LINES RUN OVER RAILWAY TRACKS

With many central power plants in operation, the problem of finding a right of way for transmission lines is important since the cost of underground cables is often prohibitive and the line frequently must pass over valuable ground. One company is using a railroad right of way for the purpose. The railroad owned no excess ground in congested areas, so it was impossible to run the lines beside the track. The company therefore built framework over the tracks to carry the lines. In the future the elevated structure may be employed as supports for the wires for electrification of the railroad.

TWO-SPEED AUTO AXLE GIVES GREATER FLEXIBILITY

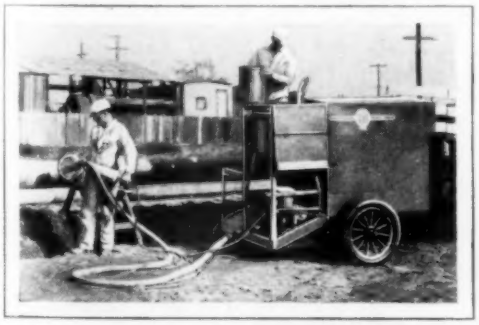


Giving Ford passenger cars and trucks the advantages of a four-speed transmission, a two-speed axle actually offers a choice of six forward speeds and two reverse. The twin

axle gives two high speeds, one a highway speed geared direct 2.84 to one, compared with the standard Ford gear of 3.77 to one, and the other a traffic speed geared semi-direct, 3.93 to one, both noiseless and easily shifted. This provides for a high rate of road speed with reduced engine revolutions. The six forward speeds are achieved by using either axle gearing desired for the two low speeds. The highway-speed gear cuts down motor revolutions one-fourth. The top speed is increased about ten per cent because, at an engine speed of forty-five miles, the road speed is sixty miles an hour. The extra gears also provide a direct saving in fuel.

PLASTER MACHINE COATS PIPE TO PREVENT CORROSION

To coat pipe lines with cement mortar and thus prevent corrosion, a compact outfit, introduced by a western firm, saves time and work and is said to apply the material so effectively that a longer-lasting coating is formed. The apparatus consists of a gasoline engine, to operate the blower, and a generator, to furnish power for the hopper and brush-head motor. Damp sand is mixed with cement and moistened as the materials pass through the machine so that a spray of fine particles of sand, each coated with the proper amount of cement, is forcibly applied to the pipe, driving away the air



Portable Outfit Used for Coating Pipe Lines with Cement Mortar to Prevent Corrosion

as it strikes the surface and clinging tightly until a suitable coating is formed. Pipes treated in this way have successfully withstood corrosion for long periods. The machine is also adapted to applying acoustical and other plasters.

Elongated Stethoscope with Folding "Ears" That Is Used to Locate Leaks in Water Pipes

FOLDING "EARS" FIND LEAKS IN WATER PIPES

Operating on the principle of the stethoscope, an instrument invented in London enables a tester to detect leaks in water pipes and also to determine in which direction the water is flowing. It is an adaptation of the principles used during the war to locate hostile aircraft. The outfit is compact and portable, and is said to be so effective that it will register sounds in pipes at a considerable depth.

PORTABLE PHOTO-PRINT PRESS IS LIGHT AND COMPACT

Taking the place of the heavy and cumbersome letter press, a portable photographic-print press now is being offered as a light and compact unit for photographers who do work while traveling. It is made of heavy oak pieces mitered together to prevent warping, and is equipped with heavy preshrunk webbing. The malleable-iron metal parts are intended to withstand many times the strain likely to be placed on them. The boards are drawn together with great pressure by the leverage principle. The lever is fastened into anchor plates, and then brought forward to exert an evenly distributed pressure throughout the press.

Courtesy Jo Sais Tout

Camera on a Swinging Crane for Taking Crowd Movies; the Crane Is Mounted on a Truck, Thus Affording Great Maneuverability

CAMERA ON A SWINGING BOOM MAKES CROWD PICTURES

To give the illusion of large masses of troops participating in battle scenes in one of the war films, cameras which made the pictures were mounted on a swinging crane which in turn rested on a heavy central column placed upright on a truck. This mobile movie equipment is capable of great maneuverability since the platform on which the cameras and cameramen stand can be moved horizontally along the length of the boom, and the boom itself can be swung in a circle or moved up or down on its base.

ELECTRONS OF SOLIDS SHOWN TO BE IN MOTION

Direct photographic evidence that myriads of electrons are rotating in orbits in solid matter at high velocities has been obtained by two scientists of the California Institute of Technology. It has long been assumed that electrons in solids, like those in gases, are in rapid motion, but this remained merely a theory until X-ray pictures offered proof. The apparatus used in obtaining the pictures consisted largely of an X-ray tube, a strip of metal to serve as a scattering body, or target, a device for gathering some of the scattered X-rays after they struck the target, and photographic instruments for reproducing the impressions made by the scattered rays. When struck by X-rays, electrons recoil just as does a billiard ball when the cue ball hits it. But recoils differ, depending on whether the billiard ball is in motion or not when the cue ball strikes it. In the experiments, the X-rays corresponded to the cue ball. Had the rays, all of uniform length at the beginning, struck a stationary object, they would have been scattered, but would still have been more or less uniform in appearance. Instead, the photograph showed a blurred band of many lines, each of which represented scattered rays of one wavelength. This indicated that the electrons were in motion.

METAL SEAL FOR AUTO BRAKES KEEPS OUT DIRT

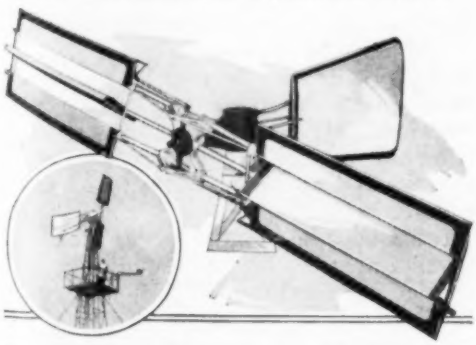
Fitting tightly over the brake drums and housing of the model-A Ford car, metal seals keep out dirt, grease and water. They are easily adjusted, require no drilling of holes or new parts.

ELECTRICAL HEATING OF SOIL USED TO SPEED CROPS

Truck growers in Europe are experimenting with a system of electric heating for the soil to obtain better and earlier crops. One farm near Berlin has an acre of ground warmed by electric cables on which early vegetables are grown. On the same farm the poultry houses are kept at constant temperature day and night, and when an egg is laid, it drops to a traveling band and is immediately carried away to be stamped with the date.

WIND ELECTRIC-POWER PLANT MOUNTED ON A DERRICK

Breezes blowing over an Indiana farm furnish all the energy required to provide electric power and lights through the medium of a wind electric-power plant somewhat resembling an ordinary windmill. The outfit consists of a wind wheel mounted on a seventy-five-foot derrick. The main body of the wheel is constructed of two pieces of sixteen-and-one-half-foot steel tubing, and at each end of the propeller inside the tubing is a weight, held in place by a spring and connected to a governor in the center of the propeller. As the speed increases, the weights cause the governor bar to turn, and this, through a system of gears, causes the dampers to turn crosswise in the path of the wind, opening up more than half the wind surface on the blade. The tail is rigid, and the wheel is stopped by a mechanical device that allows an operator on the ground to turn the damper, or sections of the blade, crosswise. The generator is mounted on a platform below.



Wind Wheel Which Generates Electric Power for a Farm; Note Blades Which Turn to Act as Dampers

Women Brickmakers in England Engaged in Pressing the Clay into Molds with the Bare Feet

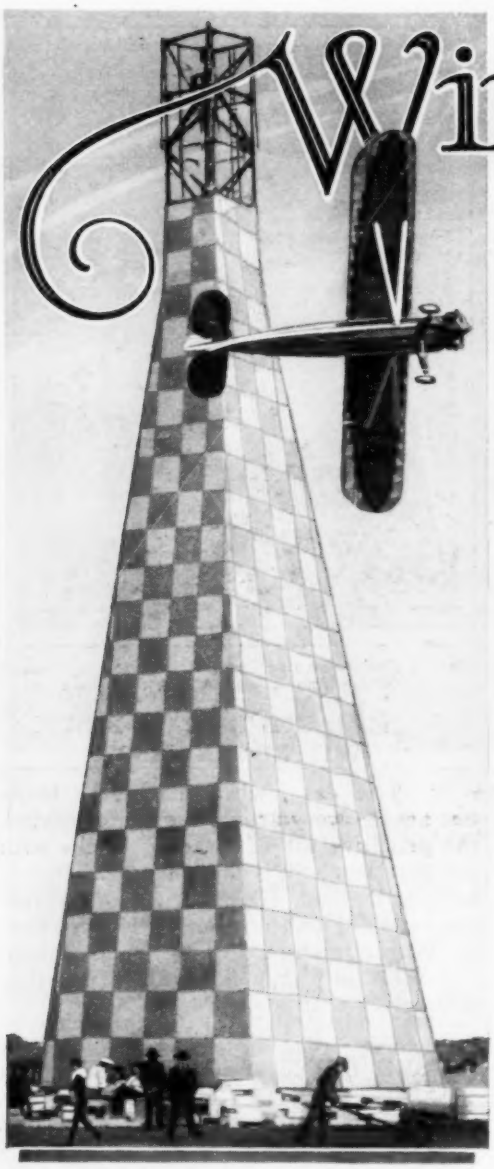
WOMEN STILL PRESS BRICK WITH BARE FEET

In these days, when machinery turns out nearly every article used by mankind, the primitive art of treading bricks with the bare feet still is practiced near Stourbridge, England. Here sturdy women, survivors of the original women brickmakers of Worcestershire, knead the clay into the molds with their feet while supporting themselves with sticks.

RAISED STITCHES ON BASEBALL TO AID PITCHERS

Fewer homeruns and three-base hits may be chalked up in baseball this year as the result of changes in the cover of the sphere. It is to be heavier, and the stitching is to be raised instead of countersunk as before. It is predicted that this change will give the pitcher a much better grip on the ball. The total weight and size of the ball remain the same in spite of the cover alterations. The National-league ball cover will be thicker than it was before, while American-league officials have adopted one of the same thickness but with heavier threads, which are expected to slow up the sphere.

Wings for



Heath Parasol Winning Light-Plane Race at 1930 National Air Races in Chicago

By CORLEY McDARMENT

FROM the thundering giants of the air with their great lifting power, ultra streamlining and high speed there has been born a newer type of airplane—a small, light low-powered machine of great efficiency and wonderfully suited for the man of average means. The possibilities for this plane, capable of carrying one to three persons, are almost unlimited. It embodies the efficiency of strictly commercial machines and even greater safety due to its lighter weight.

Small airplanes have always been built. In fact, the very first machines were little more than big gliders with a motor nailed in them. But the light planes of the past have not had those deft touches of genius, combined with the soundest principles of aerodynamics, which characterize the newly born craft.

At the present time you may buy for less than $1,000 an airplane embracing all the safety features and most of the efficiency of the bigger machines. You may buy the parts and assemble an airplane for much less.

This means that people now able to have automobiles may own an airplane. These small machines almost fly themselves. With low center of gravity, low landing speed and sturdy construction, many more people are able to learn the flying art than heretofore.

With the steady progress in building strong and efficient airplane wings and light powerful motors, it has been possible to build little machines of wonderful performance, and the many late safety devices, like wing slots and flaps, make an airplane almost fool-proof.

Everybody in the commercial-flying business has long known that airplanes would never be the success of automobiles unless a plane were developed which could be flown by sister Sue and brother Bill. And now that such a plane has appeared upon the horizon, people are wondering how far and how quickly the flying craze will go.

It has been said that every big economic advancement has been found in some new article of general use or method of work. It may be that the advent of cheap and safe airplanes for everybody will be an article which thousands or millions of

Heath Plane Equipped with Pontoons for Water Landings and Take-Offs; as a Seaplane, This Small Ship Has Given Many Creditable Performances

people will buy, and the manufacture of them will afford work for thousands.

Automobiles became personal necessities only after low-priced cars were put on the market. The safety and ease of operating automobiles was another factor in making them popular. Time was when very few people were capable of running an automobile—or at least this was the general opinion. Wealthy people used to import French chauffeurs, who were supposed to be mechanical geniuses, to run their cars. It once took a mechanical wizard to work on an automobile and the pay of mechanics and chauffeurs was high. The horseless carriage remained a mystery to the average citizen for many years. The aviation industry faces the same problems that confronted motor-car manufacturers twenty years ago.

As soon as the worth of the small airplanes is realized, the demand for them probably will be greater than it was for automobiles at the start. There are a multitude of uses for a small, light machine. Many of these uses are not thought of at all now, but the various duties would multiply after the plane is operating.

With a light airplane people may commute from farther distances; they can take long trips within a short time and without all the traffic bother of the highways; and for hunting, fishing or other forms of recreation it would be much better than a car. People usually go at least a hundred miles on fishing and hunting trips. The time it takes to make these trips by automobile, boat or train, is considerable. An average speed of thirty-five miles an hour on most country roads in the vicinity of the best hunting and fishing grounds is about the limit. But a little airplane, sailing at seventy-

Storing Heath Parasol in Shed, and Taking the Air While the Pilot Keeps Hands Off, a Demonstration of Stability

five to a hundred miles an hour, pays no attention to bad roads.

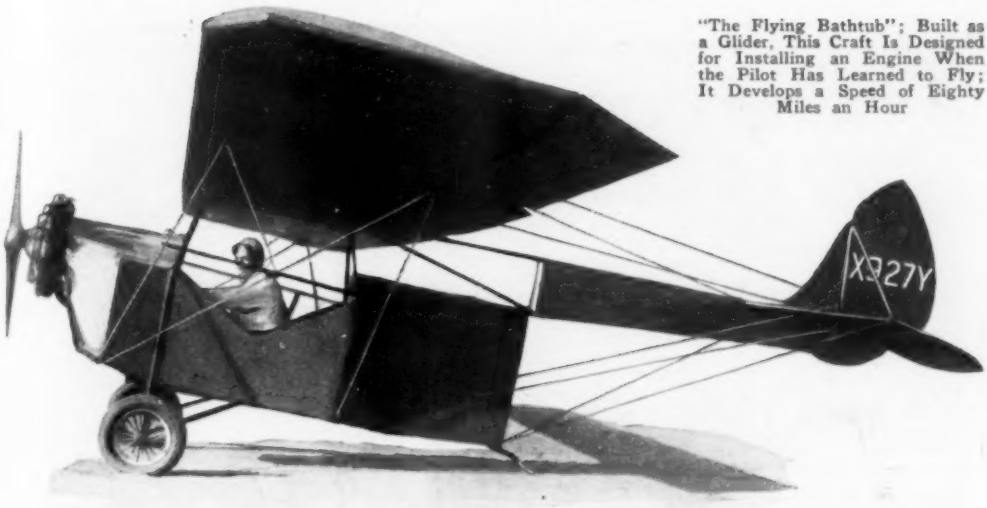
Boys going and coming from camping trips should be able to use these small machines. There is no reason why a boy in the early teens cannot learn to fly just as well as an older person. In tests, it has been shown that boys should learn to fly easier and quicker than grown people.

Farmers may be able to use these small planes to make quick trips to towns for supplies during bad-road seasons as well as at other times. Three to five hundred pounds and more may be carried in some of these new machines. Some of them have a cruising radius of 400 to 500 miles. They fly forty miles on one gallon of gasoline. Light airplane engines have been built which will run as low as sixty miles to a gallon. This is economy. With crude oil coming in as engine fuel, greater economy and safety will result.

It is not always necessary that whole loads of fuel be carried in these light planes. They will carry enough fuel to fly 400 or 500 miles, but if a person is not going to fly so far, the extra fuel may be replaced by its weight in baggage. People living in mountainous country may have rapid communication with folks living in adjacent valleys by means of these small planes. It takes a long time to climb up and down mountain ridges and get to points which, by a straight line, are quite near. The small plane may be loaded with only a part of its gasoline capacity and fly over mountain ridges into the other valleys with great ease and carry a good pay load.

People who live on islands, or other places where boat communication is slow, will find the new planes a joy and a necessity. For quick communication across rivers and lakes, nothing could be better than these little machines set on either pontoons or wheels. They are small enough to be pulled up into boat houses if they are equipped with pontoons, and a wide garage will accommodate them if set upon wheels. A few years hence, people will no doubt wonder how they ever managed to travel over rough, dusty roads in cars, or creep along the surface of water at twelve to twenty miles an hour.

Regions on the earth which are now inaccessible or have no methods of transportation, may be visited with ease by means of these light airplanes. There are beautiful spots in the Rocky mountains and the Appalachians which are seldom visited because it takes too long to get there by ordinary means. Such roads as exist wind around the mountains several times before getting to the destination. But with an airplane, a person can take off, do a little circling for altitude and quietly settle at the destination within a few minutes. If a lake exists in the mountains, a good natural landing place is thereby afforded.



"The Flying Bathtub"; Built as a Glider, This Craft Is Designed for Installing an Engine When the Pilot Has Learned to Fly; It Develops a Speed of Eighty Miles an Hour

With the new planes and their safety factors, parents should be no more afraid of letting their children go on trips by air than taking similar trips in automobiles. There are more hazards with driving automobiles today than exist with the small safety planes. Much more work is involved in driving a car on the congested roads than in flying an airplane. Aviators now who are accustomed to flying military or commercial planes, feel a sense of delight in one of the small machines.

There is no reason why light individual airplanes should cost very much money, provided they can be made in large quantities. Quantity production will cut the cost of airplanes as it has done with automobiles.

Airplane-engine cost could be cut one-half by large production. Wings, struts, landing gear, fittings, fuselage members, and all other parts, could be reduced in price at least half, if large numbers were made. It has been said that metal wings could be stamped out nearly as cheaply as automobile fenders, if enough of them were needed. In time, we may see regular airplane-assembling plants in all large towns. This will indeed be a big and new business. The radio development helped out the business depression a few years ago, and as already stated, this new airplane development may step out and create the biggest business boom the industrial world has ever known.

The wear and tear on the small light planes should be negligible. Airplanes are not subject to the same jolts and rough handling as automobiles. Friction of the air does not wear down an airplane wing, neither does it injure any other part of a plane. The mechanical side of these new airplanes is far simpler than in an automobile. There is no transmission or rear-end worries. All is straight drive and everything is in sight.

SLANG OF THE AIRWAYS

SOME of the latest additions to the growing language of aviation are explained as follows:

"Stick pusher"—a pilot.

"Horsing down"—a nosing toward earth.

"Counting the insulators"—being low enough to see telegraph poles.

"The old ladies' home"—the home airport.

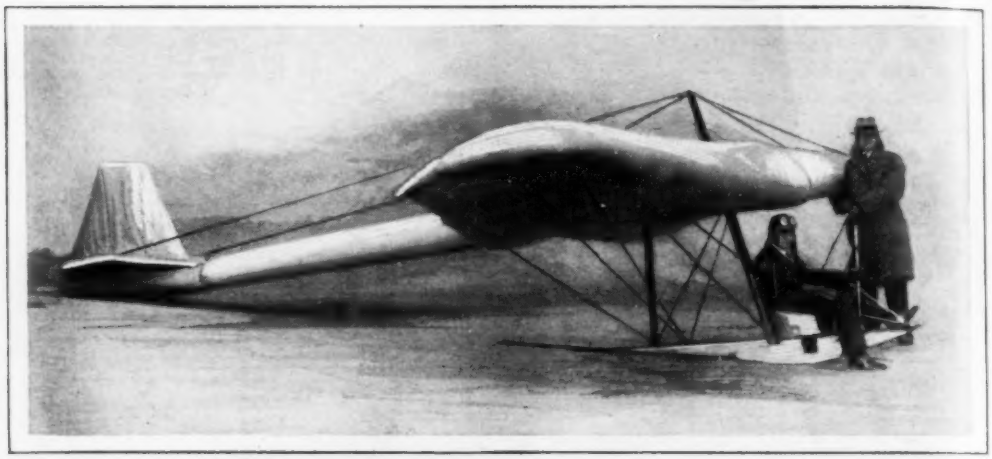
"A milk route"—short feeder airline, disdained by flying aces.

"The iron compass"—railroad tracks followed as a guide in storms.

"Windmill"—propeller.

"Big Bertha"—30-passenger Fokker plane. A 12-passenger is a "Geloppy."

"A Duck"—An amphibian plane.



Rubber Glider That Made Successful Flights at Hoover Field, Washington, D. C.; It Is Designed to Withstand Various Strains and Stresses Better than the Usual Glider

With stock airplane engines running for weeks in non-stop flights, the danger of motor stoppage in the air is reduced to a minimum. One set of tires will last an airplane a lifetime. Only by deterioration of rubber would new tires ever be needed. The big reason automobiles do not last longer than they do is the constant road vibrations. An airplane vibrates, but the strain is not so destructive as that of automobiles. And as soon as the general public finds out that small safe machines may be bought and flown with all the ease of automobile driving, there will be a bigger demand for airplanes than ever existed for any other vehicle of travel.

PACIFIC CONTAINS LESS OXYGEN THAN ATLANTIC OCEAN

There is less free oxygen in the water of the Pacific ocean than in that of the Atlantic, and there is more in the water of great deeps of both oceans than in that from moderate depths. These discoveries were made by Dr. Erik G. Moberg, oceanographer, after a chemical study of thousands of samples. Since all plant and animal life in the ocean is dependent on oxygen, the results announced are of fundamental as well as theoretical importance. The greatest oxygen content in Pacific ocean water was found at the surface, where it was nearly saturated. The content fell off with depth, until at 2,000 feet there was less than one part of oxygen per thousand of water. From this depth downward, the oxygen content increased again, reaching its highest point at the bottom. The highest deep-water oxygen ratio found was 3.45 parts per thousand.

EFFICIENCY OF LIGHTS TESTED BY PHOTO-ELECTRIC CELLS

How bright is an electric light? Photo-electric cells give the answer in an apparatus demonstrated recently in London. The lamp to be tested is placed in a cylindrical chamber where its light is converted into electrical current by means of the cell. The measure of current gives an index as to the power of the light.

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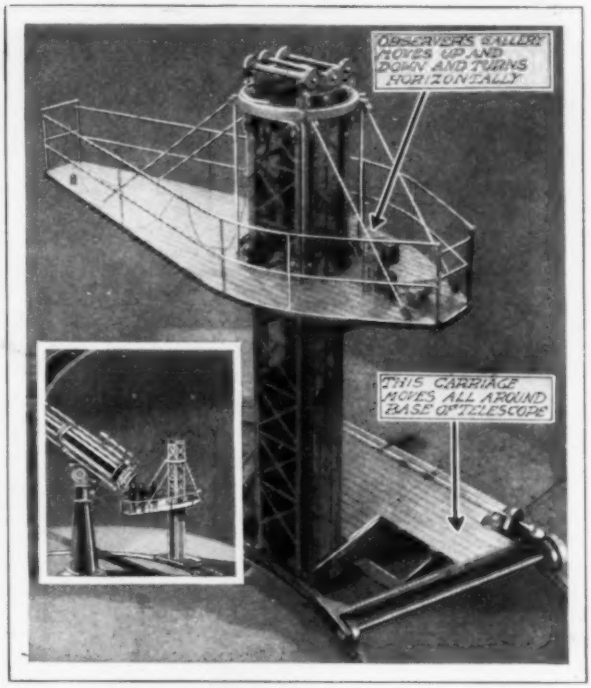
Testing Brilliance of Electric-Light Bulbs in Cylinder with Aid of Photo-Electric Cell

ASTRONOMERS RIDE PLATFORM WHILE STAR GAZING

Because large telescopes in observatories must be moved constantly in studying celestial bodies, astronomers have been common sufferers from backache and stiff necks due to the many awkward positions they must assume in order to see through the eyepiece. To make the astronomer's work easier, electrical engineers have produced a mobile telescope observer's platform on which the astronomer can ride around the dome of the observatory in comfort with his eye almost constantly glued to the telescope. This apparatus, intended for the Boyden station of Harvard observatory, at Bloomfontein, South Africa, consists of a carriage on wheels which runs around the base supporting the telescope on a circular track. Mounted on the carriage is a skeleton tower, fourteen feet high, which in turn supports a gallery or platform upon which the observer and his assistants sit or stand. The gallery can be raised or lowered, or turned horizontally about the tower, the observer's stage moving automatically with the telescope itself. The apparatus is controlled electrically by a system of relays operated by a push-button switch.

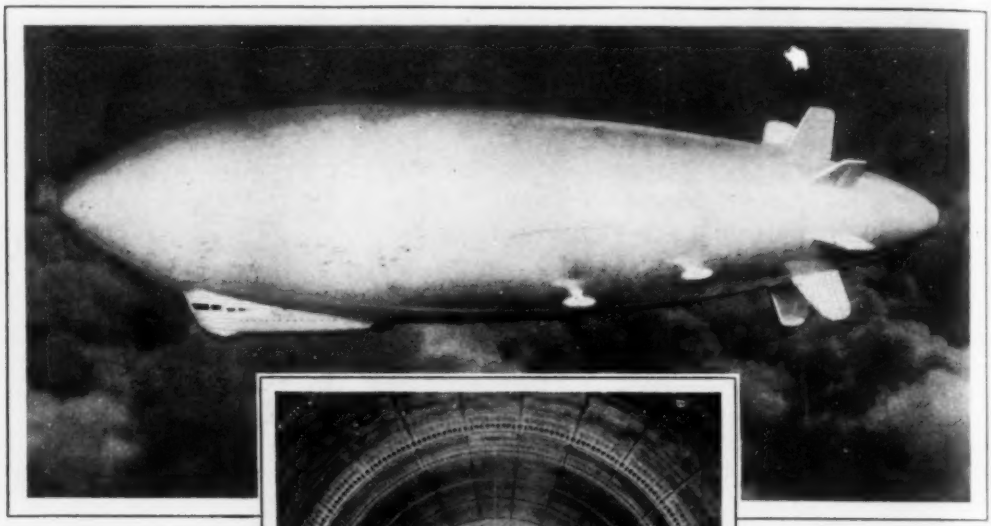


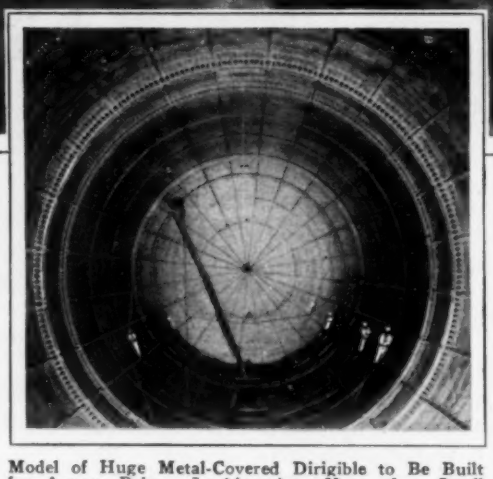
Observer's Platform from Which Astronomers Gaze through Big Telescope; Tower and Telescope Move Together

MOVIE THRILLERS COST LIVES OF FIFTY-FIVE PERSONS

Packing thrills and realism into the movies is fraught with deaths and accidents often as tragic and thrilling as the scenes depicted. During the last five years, fifty-five actors, extras and studio workmen have lost their lives in making pictures, and scores of others received permanent or temporary injuries in the effort to provide "hair-raisers" for movie fans. In addition, the California state industrial-accident commission paid out $421,850 to members of the motion-picture industry for deaths and accidents arising in the course of employment. During 1929, when war films were in vogue, sixteen lives were lost, and last year ten lives were sacrificed at one time when an airplane plunged into the ocean after colliding with another ship during the making of a film. Almost every picture of greater than average scope has its tale of bravery and daring on the part of those who helped create it, although the producers do what they can to guard against accidents. Accidents as unusual as the scenes that are portrayed, are an inevitable result of picture making. In setting off a two-ton charge of dynamite in one picture, someone underestimated the force of one of five charges, and the top of a hill was blown off, two men were killed and forty hurt. A freak blizzard, while one company was on location in the mountains, cost the lives of two men who mistook a yielding bank of snow for a road, and caused the illness of many others, while nine men were hurt, three fatally, during the making of the same picture when 500 men on horseback charged down a rocky hillside. Among minor injuries for which compensation was paid are many freaks.

METAL-COVERED AIRSHIP TO CARRY TWENTY TONS





Model of Huge Metal-Covered Dirigible to Be Built for Army; Below, Looking into Nose of a Small Metal-Clad Airship

Capable of carrying a useful load of 40,000 pounds, a huge metal-covered dirigible, larger and faster than the "Graf Zeppelin," is to be built for the army at a cost of $4,500,000. It is intended as an air tender for a fleet of airplanes. The metal "skin" of the airship will act as the container for the helium gas, being reinforced by circular rings and longitudinal members. Eight motors of 600 to 800 horsepower will drive the ship at a maximum speed of 100 miles an hour when fully loaded. This big airship will be forty times the size of the "ZMC-2," the metal-clad dirigible built in 1929 as an experiment and since thoroughly tested.

ALPHABET KNOWN IN CANAAN POTTERY INDICATES

Three signs like "hen tracks," cut into a broken scrap of pottery jar, are considered as fresh evidence of the antiquity of the alphabet by Prof. Romain Butin, of the Catholic University of America. The fragment was found at the ruins of the Canaanite royal city of Gezer and is believed to show that alphabet writing existed as early as the nineteenth century B. C. This scrap is regarded as evidence that the Canaanites, who held the Promised Land before the Children of Israel came to claim it, not only knew a system of writing, but had an alphabet. When first discovered, the fragment was classed with objects a thousand years younger than itself, until the figures were found to be similar to inscriptions found in the wilderness of Sinai, south of Palestine. The Sinai writings show evidence of having been evolved from Egyptian picture writing, and the fragment of pottery found at Gezer makes it clear that the Sinai alphabet is older than 1,600 B. C., and probably as old as 1,900 B. C. These three letters are believed to be the oldest writing ever found in Palestine. The characters, experts say, mean "Children of," the rest of the inscription being broken off, and was probably an ownership mark similar in character to the title "Children

of Israel" used centuries later. Two other evidences of alphabetizing processes have recently come to light, one found in Syria based on cuneiform signs, and the other a semi-alphabetic writing found in another section of the same country.

ELECTRIC MINE-GAS DETECTOR TO PREVENT EXPLOSIONS

To detect the presence of dangerous gas in coal and other mines, an electrical tester has been devised for use instead of canary birds or lamps with a flame. A small wire in the "nose" of the tester is kept heated to a temperature of approximately 1,000 degrees Fahrenheit. In case methane gas is encountered, the vapor automatically causes the tester to become hotter. This is recorded on a gauge carried on the chest of the miner, giving him instant warning of the dangerous gas. A special feature of the tester is that it can be used with an extension, so that the ceilings and other remote parts of the mine shafts can easily be tested. The outfit is no more cumbersome than the ordinary electric-lighting equipment worn by the miner, and presents no additional hazard in making a test.

Electrical Tester Which Quickly Detects the Presence of Dangerous Gases in Coal Mines

¶Europe has fifteen reigning monarchs and fourteen presidents.

German Cadets Listening to a Lecture on Horses with a Living Animal before Them

GENERALS OF FUTURE STUDY HORSE ANATOMY

Cadets attending a German military school are given thorough lectures on the horse as well as instruction in the use of gas masks, the firing and maintenance of machine guns and many other subjects. The cavalry lectures are given by an expert veterinarian and are illustrated with living animals and skeletons.

SEA PENETRATES EARTH'S CORE IS LATEST THEORY

To explain the fourteen great ocean currents, such as the Gulf stream, one scientist recently advanced a theory that the sea water circulates through the center of the earth by means of innumerable fissures reaching down from the ocean floor. This revolutionary idea, suggested by Dr. Richard Ammo Meentz, geologist of Southern Methodist University, is that water is sucked from the bottom of the ocean in the equatorial regions to the earth's center and then expelled in the vicinity of either the north or south poles. He conceives the interior of the earth to be composed of gaseous vapors, plastic material and solids. To support his theory, he points to the fact that fifty-seven fissures in equatorial regions with a known depth of more than 18,000 feet have been located.

From the Ground to the Air in a Few Easy Lessons; the Plane That Cannot Fly, Shown Below, Gives First Training

PLANE THAT "FLIES" ON GROUND HELPS TRAIN PILOTS

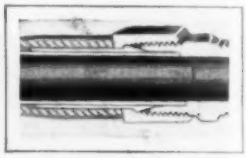
Student pilots are taught the first essentials of flying by practice in a special training plane, identically the same as a real ship except that it has insufficient wing area to allow it to leave the ground. The student soon becomes familiar with the different controls, how they affect the plane, and what to do in various maneuvers as he taxis around the landing field. When he is ready for the air, the transition to a plane that flies is said to be accomplished with little difficulty.

BALL-BEARINGS IN SWIVEL ELIMINATE SQUEAK

Ball-bearing swivels for suspending porch swings, bird cages, block-and-tackle chain hoists, and many other units, reduce friction to a minimum and eliminate unpleasant squeaks and rasping noises. A feature of equal importance is that the swivel prevents the cables, ropes or chains from becoming twisted.

BREAK-PROOF FUEL TUBE AIDS PLANE SAFETY

Broken fuel or oil lines have been a frequent source of trouble to aviators, but this difficulty may be entirely eliminated through the introduction of a kind of tubing that will not break under the strain of engine vibrations and other stresses. The secret of its strength lies in the fact that an oil-proof fabricated-rubber covering has been vulcanized to the copper or aluminum tubing. If the metal tubing should break, there will be no leak, for the outer covering will still retain the oil or gasoline. If a crack in the line does occur while flying, the fact will be apparent in a small hump at the point of fracture. This can be remedied by inspection and repair crews at the hangar.



RAYS OF DAYLIGHT HARNESSED TO RUN SMALL MOTOR

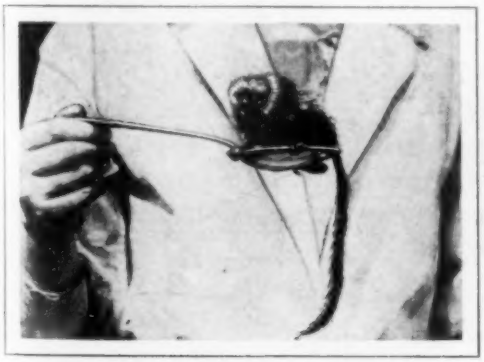
Operation of a half-volt motor on energy supplied by the rays of daylight alone is the claim made recently by Dr. Bruno Lange, Berlin scientist. The energy was created by the action of light on a special metal-alloy plate. The motor gets its power from light reacting on a photo-electric cell which transmits the energy directly to the motor, the cell being actu-ated strongly by the invisible red and ultra-red rays. Doctor Lange said he expected the process of thus utilizing the sun's energy will greatly affect the future of both television and talking pictures.

NURSERY FOR BREEDING BUGS TO WAR ON INSECT PESTS

Imported bugs will be coddled in the lap of luxury in an "insectary" in California erected for the breeding and care of beneficial insects that are raised to war on crop pests, particularly those attacking citrus fruit. The structure is an H-shaped building of reinforced concrete with tile roof and over-all dimensions of about 100 by fifty feet. There are twenty insect-rearing rooms in the four wings. The plant has been made insect-proof to keep the nursery bugs in and others out. Corridors are painted black and lights are extinguished when doors are opened to avoid attracting the bugs. All electric fixtures are insect-proof and gas-tight. Twelve changes of air are provided hourly, the air-conditioning system removing dirt and supplying proper humidity and temperature. Each nursery room is equipped with an electric heating unit and a thermostat providing a temperature range from seventy to ninety degrees. Air ducts are covered with silk screens and supply and exhaust ducts are fitted with air-tight dampers so rooms may be closed and fumigated at any time.

TEASPOON HOLDS TINY MONKEY FOUND IN SOUTH AMERICA

So small that it can be placed comfortably in an ordinary teaspoon, a tiny monkey found in South America recently was placed on exhibition in the London zoo. It is a pigmy marmoset, has a tail three times its length, and weighs less than a pound.



Pigmy Marmoset Monkey Which Is So Small That It Rests Comfortably in a Teaspoon

Headrest for Photo Flash Bulb and Battery; the Camera Shutter Sets Off the Flashlight

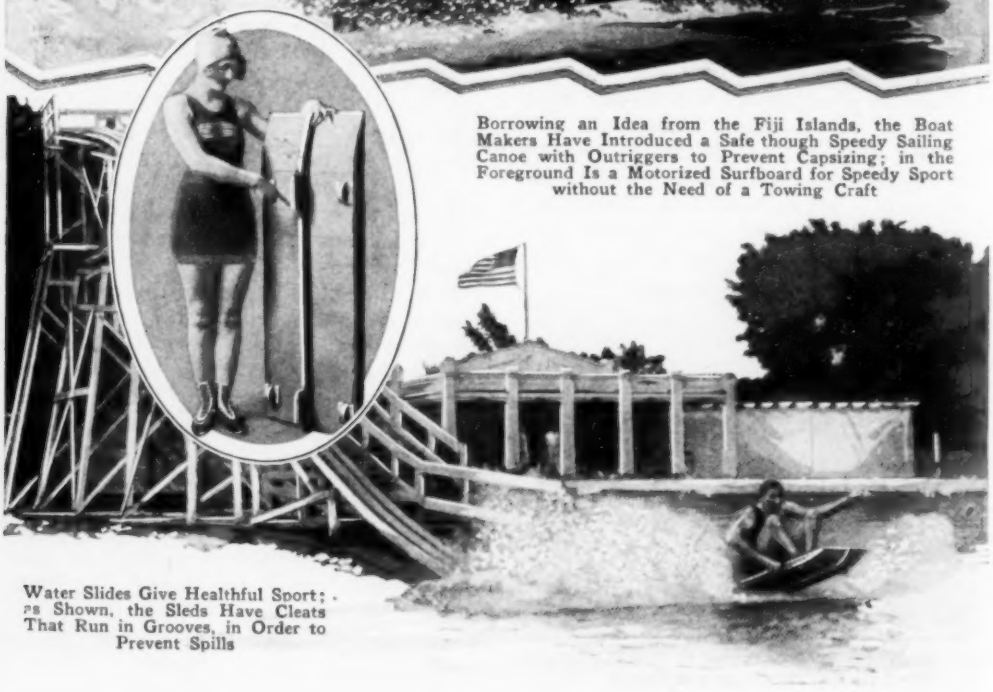
FLASH LAMP RESTING ON HEAD OPERATES WITH CAMERA

Electric photo-flashlamps for making snapshots now are being placed by some photographers in a receptacle which fits on top of the operator's head, the lamp-rest being held by a broad band which passes about the face and under the chin. This places the bulb higher and farther away from the camera than when held in the hand, and eliminates the need of a tripod, both hands being free to hold and operate the camera. A porcelain lamp socket is fastened to a small wooden base, a flat-type pocket flashlight battery being inserted beneath the base and clamped by means of a similar board. The underside of the board is padded to fit the head, and a removable aluminum reflector is attached with thumbscrews to the back of the lamp base. From the bulb a lamp cord extends to the camera, terminating in contacts mounted on a bakelite block that can be plugged into the frame supporting the shutter. This provides a unit readily detachable from the camera, and, in operation, the contacts are pressed together when the shutter is released, thus closing the circuit to set off the flash.

¶Arizona contains the most extensive pine forests in this country.

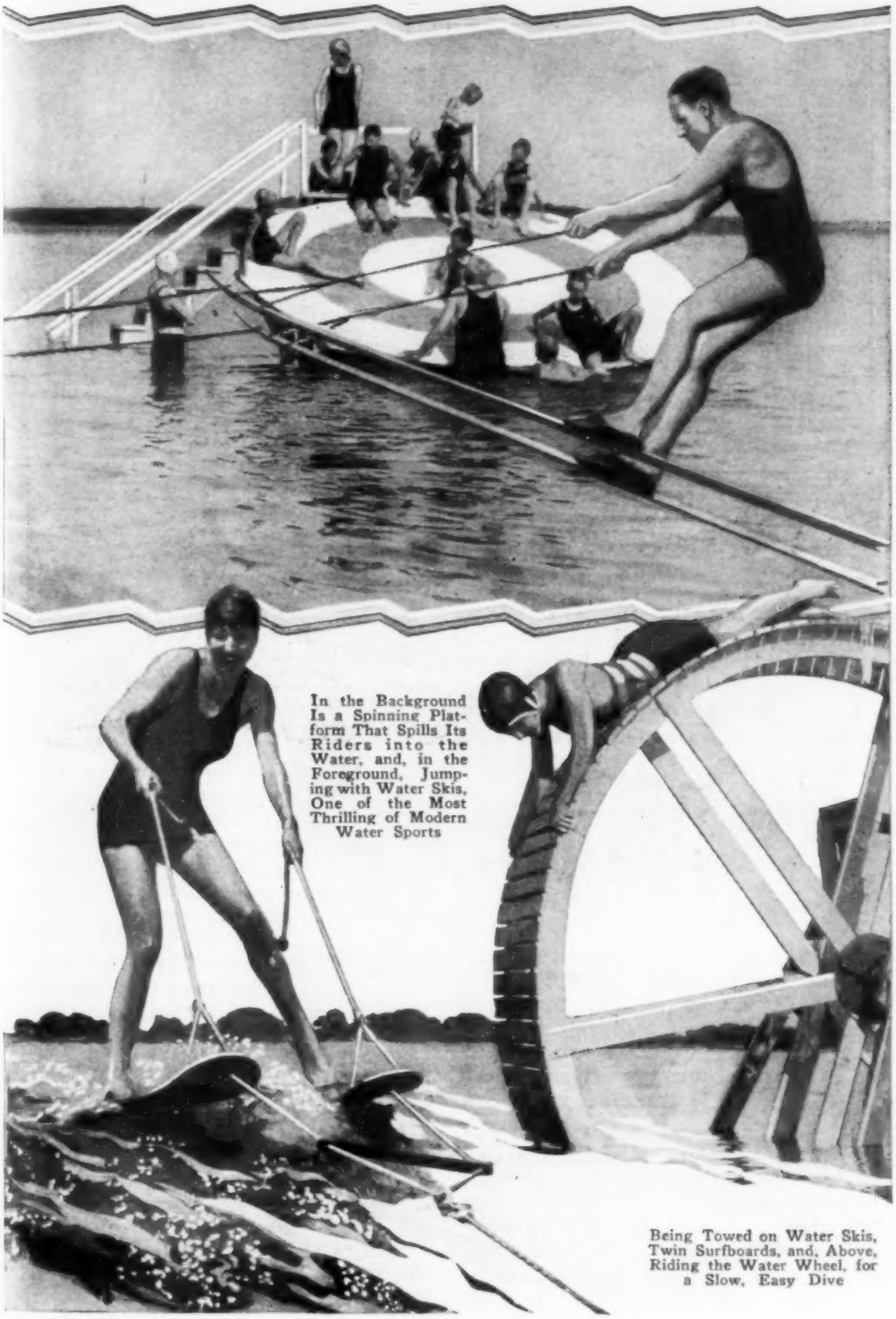
FUN AND THRILLS ARE COMBINED IN THE LATEST

Borrowing an Idea from the Fiji Islands, the Boat Makers Have Introduced a Safe though Speedy Sailing Canoe with Outriggers to Prevent Capsizing; in the Foreground Is a Motorized Surfboard for Speedy Sport without the Need of a Towing Craft



Water Slides Give Healthful Sport; as Shown, the Sleds Have Cleats That Run in Grooves, in Order to Prevent Spills

WATER SPORTS SEEN AT THE WINTER BEACHES



In the Background Is a Spinning Platform That Spills Its Riders into the Water, and, in the Foreground, Jumping with Water Skis, One of the Most Thrilling of Modern Water Sports

Being Towed on Water Skis, Twin Surfboards, and, Above, Riding the Water Wheel, for a Slow, Easy Dive

TINYTOWN ATTRACTS THOUSANDS OF SIGHT-SEERS

Above, a Bird's-Eye View of "Tinytown"; Center, a Business Block in Winter; Below, a Residential Street in This Lilliputian City

On the banks of a mountain stream near Denver is a Lilliputian city of doll houses, complete in every detail of the modern town, and built exactly to scale throughout. Known as "Tinytown," the little city covers half an acre and has residences three feet tall, cement sidewalks, graveled streets, electric lights on ornamental posts, and other modern improvements. It was started by a Denver man whose little daughter wanted a doll house. From the one home, the Lilliputian settlement grew to a village and then to a town as additions were made, until today it is a Mecca for children and attracts thousands of sight-seers. When the village was started, each home was landscaped. It grew like any other town, a railroad finally passing through it, and the coming of the iron horse was followed by a boom and the building of the corner drug store, a filling station, hotel, pool hall and barber shop. Then a cultural wave hit Tinytown, and a theater, library, movie show, parks, playground, and finally a pool in which a small steamer floats, were added. The town had one flurry of excitement when its builder, reverting to frontier memories, developed a gold-mining camp on a hill back of the village. This camp also is built to scale and complete in detail, including shaft houses and reduction mills. Every building in the town is wired for

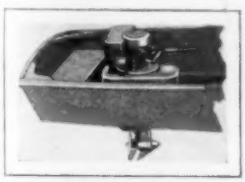
electricity, and at night the hamlet is a blaze of lights. Lawns are carefully sprinkled and clipped by an attendant, the gravel streets kept smooth and clean, and buildings are painted frequently.

BUTCHERSHOP HAS NO BUTCHER

Butcherless meat shops are appearing throughout the country as one of the latest developments of the chain-store and package-merchandising idea. Meats are already weighed and are displayed, wrapped in transparent material, in refrigerated, mirror-backed show cases where the shopper can observe their quality and the price too. This kind of butcher shop is merely a distributing center for the central cooling rooms and packing houses where the meats are cut, trimmed, sorted, inspected and wrapped. The improved refrigeration methods under which they are kept are said to insure better cooking, better flavor and increased nutriment.

OUTBOARD MOTOR RUN INBOARD ON BOAT OR CANOE

Adapted to practically all kinds of small boats or canoes, a motor case installed in the hull, puts the outboard motor inboard with several desirable features, according to the manufacturers. The boat will develop higher speed, it is held, since the propeller is always in water; there is a special attachment which is said to increase steering efficiency, and certain power losses are eliminated. The case does not prevent the tilting of the drive and motor so that full propeller protection is afforded, and boats equipped with the device can be dragged upon the wharf without damage to the motor just as in the case of outboards. Boats so rigged are said to run quietly and smoothly.



¶The world investment in radio broadcasting and receiving was calculated as of November, 1929, at $1,502,019,720, of which ninety-eight per cent was listeners' outlay.

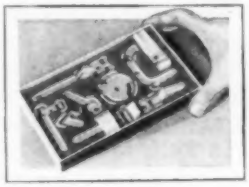
Pouring Poison Sirup into Special Stone Jars, Which Are Placed in the Garden to Kill Ants

POISON SIRUP IN STONE JARS KILLS INSECT PESTS

Containing a poison sirup, vitrified stone jars that will not upset nor allow the entrance of water, are set about the garden or other places to kill ants and other insect pests. The liquid is not instantly fatal, but is certain, and since, in the case of ants, for instance, it is taken to the nests by the workers, it will soon exterminate the entire colony.

GOLF COURSE FITTING POCKET CONTAINS NINE HOLES

Golf courses now have shrunk to coat-pocket size, and one amusement device includes a full nine-hole course contained in a cardboard box measuring only four by seven inches. "Strokes" are made by tipping the box so that a steel ball rolls toward the proper hole. If it strikes a trap it drops in and emerges at another opening, counting as one stroke. If it travels safely to the hole aimed at, it emerges at still another opening and the play proceeds to the next tee. The game should be interesting to both young and old.



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Adjusting Record in Phonograph Which Gives Lectures on Art to Visitors in a German Museum

RECORDS AS MUSEUM GUIDE HELP EXPLAIN PICTURES

Visitors at a German art museum may listen to a description of the paintings and other objects from a phonograph which serves as a substitute for a human guide. The tone may be amplified to serve a large or small crowd, and the records are changed by an attendant.

BUSINESS OFFICE WITH WINGS HAS COMFORTS OF HOME

Most of the comforts of a modern home are present in a big tri-motored airplane used as a business office by executives of a large corporation in making cross-country trips. Features of the luxurious ship include a buffet, gas stove, refrigerator, overstuffed furniture, Pullman beds, radio for amusement broadcasts, telephone service between passengers and pilots, and hot and cold running water. The plane, driven by three 525-horsepower motors, has a high speed of 145 miles an hour and a cruising speed of 120 miles an hour. It can fly from New York to San Francisco with only three stops for fueling. The pilots' compartment has ninety controls and instruments or aids to navigation. There is a special night-flying equipment and radio-telephone enabling the pilots to talk with ground stations or other planes. The ship has a wing span of eighty feet.

"STILL" PICTURE OF HIGH SPEED ENGINE TAKEN BY AID OF NEW TUBE

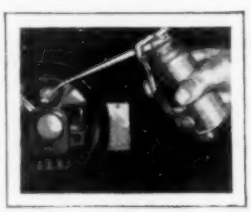
To study the behavior of machines while they are operating at high speed by "stopping" or slowing down the rapid motion so the eye can perceive it, an improved type of instrument, known as a stroboscope, has recently been developed. With this apparatus it is possible to take still or moving pictures showing the moving parts of speeding machinery in clear detail. Such pictures are made possible by using a thyratron mercury-arc tube, the intense actinic light which allows making photographs at exposures of ten-millionths of a second. In the accompanying picture of a 160-horsepower motor, for instance, the north and south poles of the rotor marked by the letters moved past the lens at ninety-five miles an hour.

"Still" Picture of Machinery Moving at High Speed, Taken to Study the Parts in Motion

MYSTERY OF MOON'S SURFACE STUDIED WITH NEW AIDS

What is the moon made of? Scientists are not certain, but they are studying the mystery with sensitive instruments that measure the heat from the distant stars, special eyepieces for the big telescopes, and other apparatus that have been devised to explore the mysteries of the heavens and the earth. By comparing the behavior of light as it strikes the surface of the moon with its action when it comes in contact with certain known substances on earth, a clue is obtained as to the character of the moon's surface. A special polarizing eyepiece is fitted into the big telescope to help study how the light is reflected from the moon. Astronomers now feel reasonably certain that the moon's surface contains no appreciable amount of basalt, as the light is not reflected from the moon in the way that it is reflected from that volcanic rock. The moon is being carefully studied with a thermocouple, an electrical heat-registering device so sensitive that it records the heat from the stars millions of miles farther away from the earth than the moon, and from this investigation the searchers are assured that the satellite must be covered with an unusually good heat-insulating material, something which reflects most of the heat rays from the sun. Dr. Paul Epstein, of the California Institute of Technology, says that the only known substance which insulates so well is pumicestone or volcanic ash.

OILCAN WITH PISTOL TRIGGER HAS FORCE-FEED PUMP



Small oilcans with forced-feed attachments now are being offered, one of the handy models operating the pressure pump by means of a trigger. The can has an angle spout and the trigger projects at the side of the oiler so that the container can be held and operated by one hand. The pump is made entirely of metal parts and has no leather plungers or valves that would be likely to get out of order.

Holding Stencil with Special Tape While Painting, and Close View of a Roll of the Tape

SHIELD TAPE HOLDS STENCILS TO SPEED PAINT JOBS

Time and labor are saved in using stencils on various painting jobs by employing lengths of a recently developed form of adhesive shielding tape. It sticks the stencils to the wall, leaving both hands free for work, aids in producing panel effects, in striping and in many other operations. A strip or two of it applied to the woodwork, window trim, sills or other parts, protect them from smears when the other surfaces are being painted. The tape is furnished in several widths, and requires no wetting or heating to make it stick.

ROCK THAT RESEMBLES CORK FLOATS ON WATER

Found mostly in the Swiss Tyrol, a rare specimen of rock known as mountain cork, floats on water and has about the consistency of a sponge. It is actually a form of asbestos, and appears in chunks like other rocks, or in layers that are called mountain leather. In the latter form the rock resembles tough gray leather. Several rocks or other minerals will float on water. Pumicestone will stay up until it is waterlogged, and meerschaum indefinitely.

The Luck of the

By JOHN L. DRAPER

MEMORIAL Day at the Indianapolis motor speedway. One hundred thousand fans shout for a winner. Jules Ellingboe tears down the straightaway with a pack of screaming motors on his trail. Around the north turn, he skims across the thirty-six degree bank, and as his car levels off, it hops the track and leaps for a wall.

One instant later, Norman Batten skids around that fatal curve. Road clear ahead. Norman's big right toe spurs his motor. Zip! Half a spring leaf from Ellingboe's wreck flies after Norman like a javelin, and drills through the gas tank. Norman clips 140 miles per hour down the straightaway, drowned in a geyser of fire. A pillar of flame forty feet high, and to stunned spectators it looks like Norman had sacrificed his life for a sport.

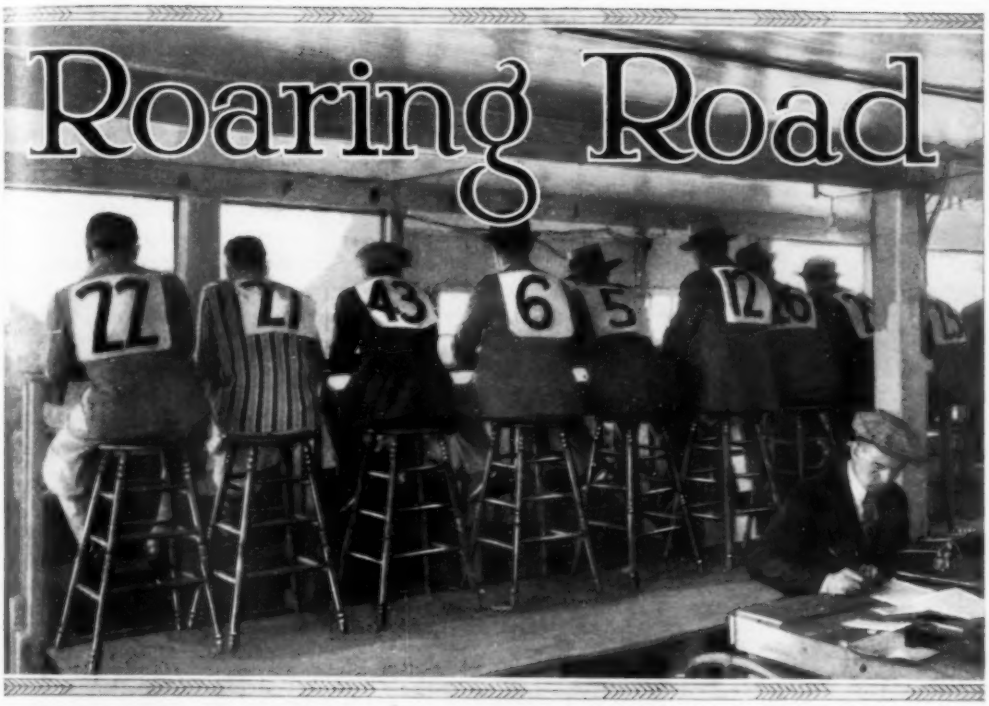
But the race goes on. The cranky motors whine around the oval. Norman's car slows down to a snail's pace, thirty-five miles per hour. Inside the furnace, he fights for air, and for brakes. The brakes jam. He jumps in burning clothes. No skipper ever held a ship as Norman did that car. Had he allowed it to run amuck, it might have plowed into the wooden grandstands and endangered the lives of 100,000 people. It is the only time on record that the timing crew failed to score a car. In five months, Norman came out of a hospital.

Above, Billy Arnold, Winner of the 1930 Indianapolis Speedway Classic, and His Mechanic; Below, Start of a 500-Mile Race

Racers, and men who know racing, are disposed to call that the most valorous performance they have seen on a speedway. And the race track, as every one knows, demands nerve and valor above all.

In the early days of racing, when entries were run by hired chauffeurs driving

Roaring Road



A View of the Individual Scorers of Racing Cars at the Indianapolis Speedway; Each Man Carries on His Back the Number of the Car Whose Position He Is Checking

for wealthy men, sport was the principal motive. Auto racing was like horse racing. Blue-blooded mares will not be much better tomorrow than today, but automobiles are improved by grueling tests on the race track. No less than seventy-five per cent of the refinement in modern machines came from the speedway. Four-wheel brakes and eight-cylinder-in-line motors grew up at Indianapolis. Also the front-wheel drive. And the maximum cylinder displacement has been reduced, from 300 cubic inches in 1915, to 183 cubic inches in 1920, to 122 cubic inches in 1925, down to ninety cubic inches recently.

But if the speedway is a proving ground for steel, rubber and hydrocarbons, it is nothing less for men. Chester S. Ricker, American Automobile Association director of timing and scoring, who has officiated at racing events since 1907, told me that the new vintage of auto racers are technically trained in engineering schools at universities

Frank Lockhart, a kingpin in racing, was the first of a line of university-trained men to bring his skill to the speedway. Lockhart suffered an untimely death when his Stutz "Bearcat" turned turtle at Daytona Beach. However, most of the engineer-drivers still attend a training school that has bred many racers, the dirt track. Dare-devils still make good on dirt, but they have little chance in a classic on hard surface. Your ideal driver attends school, masters the theory of internal-combustion engines, and while still in his early twenties, starts training on small dirt tracks. Here he acquires finesse and courage, so that when he finally drives in a classic, his mental and physical equipment are well-nigh perfect.

In the old guard, Earl Cooper was the only driver-engineer, and perhaps that accounts for the fact that he was America's champion racer in 1909 and 1910. Since the war, the old drivers who started racing as barnstormers have been displaced by daring young men who pit a technical education and skill against mere daredeviltry. We now have a breed of drivers so sensitive to the qualities of metals, rubber and fuel that they can drive cars to the utmost without damaging them; whereas, one who possesses courage without knowledge is sure to overstep the

limits of possible speed, or he feels so uncertain of his power plant that he lags in the race.

The Anglo-Saxons brought speed to the race, particularly the Americans, although Major Seagrave's record still stands. But all the world respects the French for bringing style to the speedway. In the balmy days when Paul Sartori drove a Fiat for Alfred Vanderbilt, when Bernin drove Clifford Brokaw's Renault, and Harry Grant ran his Alco neck-and-neck with Mercedes, Chalmers and Duracqs, when the classics were held at Fairmount Park and Briarcliff; in those precious bygone days, no man was a driver unless his garments were greasy, grimy and, often, filthy. It got to be an axiom that a racer was not worth his weight in petrol unless his face and clothes were soiled.

Jules Goux, a gentleman from Gaul, came to Indianapolis on a memorable Memorial Day, in 1913. His little Peugeot had multiple valves—four per cylinder. And Jules walked off with the race. That called attention to his personality. The American drivers ended up as usual, bathed in dirt and grease. But Jules was a Rue de la Paix magnifico. Swanky and stylish, gracious and courteous, he stepped out of his seat, dressed in bright checkered puttees, a tight-fitting blue shirt to match his Peugeot, and, behold!—a racing helmet, spotless and immaculate. Secretly, they made a demigod out of Jules, and to this day, American racing drivers have followed his example, although he himself was well-nigh inimitable.

Dave Lewis, now dead, also contributed to style in racing. He drove the first front-wheel drive in a 500-mile classic, the car owned by Cliff Durant, millionaire sportsman. In fast driving, Lewis found that the front wheels threw castor oil back into his face. His simple remedy was a powder puff affixed to the steering wheel. Attached to a rubber band, the puff would fly back into place after the driver had wiped a drop of oil off his face.

While drivers began taking powder puffs seriously, they also began to wear corsets, another French innovation, first introduced at Atlanta. Can a man expect his body to sustain what will break any but the strongest steel? All 500-mile racers now wear corsets of gauze, a bandage extending from the hips to the armpits, and from wrists to elbow.

Jimmy Murphy is still god of the American speedway, the greatest driver in his-

Another View of the Individual Car Scorers; Each Man Keeps Track of One Car Only, and the Man on the Right Was Scoring the Car in Leading Position When Picture Was Taken

tory. He started barnstorming in 1909, and drove his chariots over dirt, clay, gravel, sand, brick and concrete. In the period when racing entries were made by leading manufacturers, Jimmy piloted a Dusenberg, and won the 500-mile contest in 1922. When he first entered speedways, drivers had to win or there was nothing to eat. He won a great many races, and in one year earned $110,000. He was a great mechanic as well as a driver; thus he mastered the art of "tooling" a car around the oval. Jimmy Murphy was the last of the "by-guess and by-God boys." Frank Lockhart ranks after him.

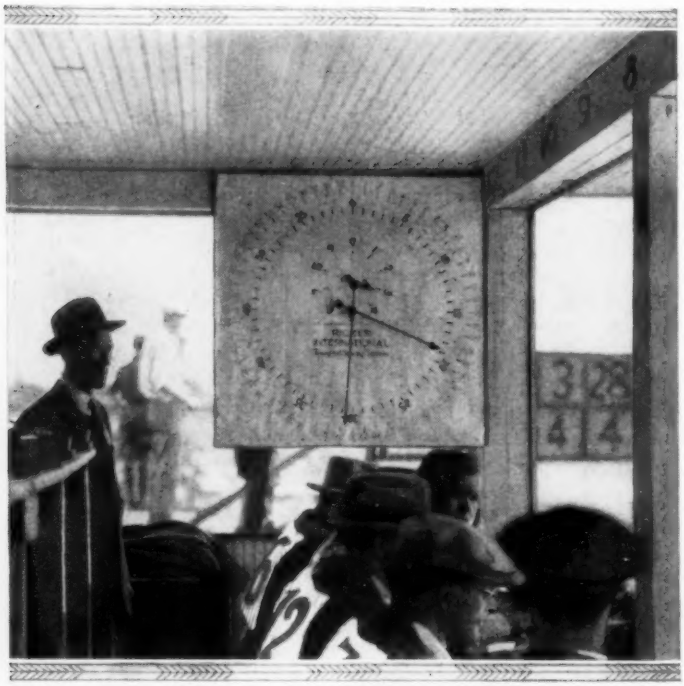
Above, a Wreck at the Indianapolis Motor Speedway during the 1930 Race; Below, Tommy Milton at End of a Winning Race

"We had a most exciting time," Ricker said, "when Louis Chevrolet drove a Frontenac around the track and threw off a front wheel while driving seventy-five miles per hour. With superhuman strength he held the car to her groove and drove more than a mile on three wheels. Aiming for the pits, he cut the timing wire stretched across the track, causing it to coil around the neck of Elmer Shannon as he raced down the home stretch. Shannon's injuries were slight.

"In 1914, Ray Gilhooley took the southwest turn at high speed and spun around three times, blocking traffic so well that Joe Dawson, his successor, smacked Gilhooley's car, and both of them rolled down the inside of the track. Ever since, a spin or bad turn is called a 'Gilhooley'."

Since the successful driver wins handsome rewards, a contestant takes the best possible care of himself. Two or three days before races, he submits to a medical examination. To train his eye for speed, and to co-ordinate his senses, he boxes or he plays handball. He gets a full quota of sleep. A rule of the speedway is that he cannot work on his car the night before the race. One thing he does not do, however, is diet.

For 500-mile races, the average speed is around 100 miles per hour. Roughly it requires five hours to see the race over, during which the car speed at various times goes up to 130 and 140 miles per hour. All cars carry tachometers to tell revolutions per minute of the crankshaft. During a 500-mile race, the crankshaft



Clock Synchronized with Electric Timer; It Ticks Off the Seconds so Each Car Scorer Is Able to Time His Own Racer

makes about 2,500,000 revolutions, while the spark plugs flash 10,000,000 times.

Now compare the speed of these racers with other forms of locomotion. Running at about fourteen and a half miles per hour, the fastest sprinter would cover seventy-two and a half miles in five hours, and it would take him thirty-four and a half hours to finish the race (if he could run that long). An ice skater, at thirty-one miles per hour would require sixteen hours to finish. An ocean steamship would require fifteen hours. The running horse, at forty miles per hour would arrive at his goal in twelve and a half hours, and a swift American destroyer, at forty-five miles per hour, would require about eleven hours, while a fast railway train, at ninety miles per hour, would finish in five and a half hours. Only an airplane can outstrip the automobile.

One hundred men are necessary to take care of the timing and scoring. And they are kept so busy that Ricker, the chief, confesses that he hasn't seen a race since 1905. The judges depend upon the calculations of Ricker and his staff, and so do the drivers.

"If we only had to worry about the bookkeeping end of the race," said Ricker, "it would be easy, but the modern public-address system, the radio hookup, combined with lap prize scoring and press reports, completely upset the system we used before the war. Announcing is now considered as important a function of scoring as bookkeeping."

COTTONSEED FED TO FISH

Cottonseed meal has been found to be one of the most satisfactory plant products for rearing brook trout. It cannot be fed alone, but is mixed with equal parts of dry skim milk and a good quality of fish meal. This dry feed is made into a paste with water and combined with a small quantity of raw meat. On the other hand, linseed meal will poison brook trout, killing them in a few weeks.

TRUNK ATTACHED TO CAR DOOR CARRIES EXTRA LUGGAGE

Extra luggage on the motor trip now can be carried in spare trunks that are attached quickly to the car doors. The trunks allow doors to swing open and do not interfere with the opening and closing of the windows, nor do they mar the finish of the auto. They also may take the place of luggage racks at the rear of the car.

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

RADIO LIGHTHOUSE THAT TALKS WARNS SHIPS OF DANGER

Vessels in the Firth of Clyde are protected by a lighthouse that "talks," the speaking beacon consisting merely of a combination of a radio transmitter and a lighthouse foghorn. A phonograph record furnishes the words and sounds that go out by radio, and a ship's wireless operator, by listening to what he hears, can compute the vessel's exact distance from the lighthouse. At regular intervals the name of the beacon is broadcast, this being followed by three blasts of the foghorn. A bell then is sounded five times, the intervals representing the time necessary for sound to travel a mile. Thus a vessel that heard the foghorn on the radio, then heard the actual sound of the horn at the third tap of the bell would be three miles from the lighthouse, the system being based on the fact that radio waves are transmitted almost instantaneously while sound travels much more slowly. The apparatus has a five-mile range.

DWARF HIPPO BORN IN ZOO ATTRACTS CROWDS

Comparatively few wild animals give birth to young while in captivity, so when

Attendant Playing with Baby Dwarf Hippopotamus, Born in Berlin Zoo; This Is a Rare Species Native to Western Africa

a baby dwarf hippopotamus arrived at the Berlin zoo, the event excited wide interest. The hippo is one of the largest animals, often weighing three tons and more, but the dwarf species, found chiefly in the rivers of western Africa, is much smaller as the youngster shown in the accompanying photograph indicates.

Applying Plastic Substance from Tube to Form Tough and Durable Gaskets for Engine Parts

PLASTIC SERVES AS GASKET AND STOPS OIL LEAKS

To replace small gaskets in motors, a plastic substance, applied from a tube, has proved effective. It is easily put on, is said not to become hard and brittle, but to remain plastic even under the terrific heat, and so is easily scraped off when the parts are disassembled. The material was given exacting tests at the Indianapolis races last year and proved especially satisfactory as a time and labor-saver.

COTTON DRIER BLOWS HOT AIR TO REMOVE MOISTURE

To remove surplus moisture from cotton before it is ginned, a drier of the blower type is now being produced. The desired moisture for ginned cotton is about eight and one-half per cent, and the drier passes all cotton of this degree directly into the gin, but removes excess moisture from what is left. Warm air is drawn by a suction fan over a steam radiator, and the cotton is conveyed into the hot air and thence into a revolving cylindrical tube, so constructed as to retard only the cotton containing too much moisture. It costs only a few cents to run a bale through the machine, which often results in raising the grade from one to two points.

TRICKS IN FIGHTING OIL FIRES CONQUER WELLS

Courtesy Deep Oil Corp.

There are tricks to every trade, oil-well fire fighting included. Take the oil and gas fire at the "Wild Abe" well near Tulsa, Okla., recently. The rotary drills were down slightly more than 3,000 feet, when suddenly a blow-out shot 1,550 feet of heavy drill pipe clear out of the hole, wrecking rig and derrick. Sparks ignited the gas, and in a few seconds, a geyser of flame, visible seventy miles away, was roaring skyward. How the fire was put out and the well capped is one of the stirring stories in which the oil fields abound. Tricks played an important part in the conquest.

The first trick was to drag away all the metal debris, for metal is a greater hazard than wood after the oil-well fire has started. It gets so hot that it will re-ignite the gas and start the trouble all over even after the fire has been extinguished. About eighty-five tons of metal were dragged out of the flames of "Wild Abe" before direct attack was made on the fire. Then the workers used another trick. Instead of wearing heavy suits of fireproof material that get tiringly heavy when soaked with water, they wore lighter but just as effective clothing of heavy wool, woolen gloves and woolen caps that came down over the ears and back of the neck. The men were drenched with water before they went into the fire and lines of hose were played upon them, while they labored in the fire, by assistants who operated from behind metal shields. The steel derrick and part of the drill pipe had to be cut with torches before it could be hauled away. Oxygen hose leading to the torches was kept wet to prevent it from melting. It took three shots of nitroglycerine to snuff out the flaming geyser, then cap it. The final victory was won with a steel nipple and valve anchored into place.

Pouring Water on Debris around "Wild Abe" from Behind Steel Screen, and Getting Ready to Shoot Out the Flame

"SINGING" ARC LIGHT TO AID TELEVISION RECEPTION

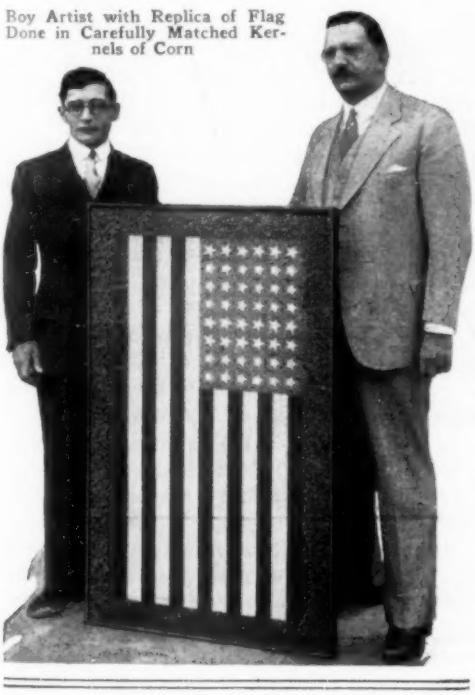
Finding a sufficiently brilliant light to use at the receiving end of the television circuit has been one of the problems that has perplexed inventors, but a solution of the difficulty is suggested by J. L. Baird, British television pioneer, in his experiments with the "singing" arc light. Its great brilliancy, and the fact that it varies

instantly with the current supplied to it, adapt it to the special requirements of television, Mr. Baird demonstrated. He and other engineers have shown how it can be made to sing or talk. When a high-frequency current is superimposed upon the current supplying the carbons in the light, the arc varies in step with the frequencies, causing air waves to radiate from the light. If the high-frequency is modulated by a microphone, the arc acts as a loud speaker, reproducing the voice or music. The light varies also, and it is this property which makes the arc fit for television. Neon tubes have been widely used for receivers, but they do not furnish sufficient light to enable projection of the image through a lens and upon a screen.

FLAG DESIGN IN CORN KERNELS SHOWS BOY'S SKILL

Thousands of colored corn kernels have been formed into an accurate mosaic representing the United States flag, by a Los Angeles boy. Much time and considerable skill were required to select kernels of the right color and size to form a smooth pattern.

Boy Artist with Replica of Flag Done in Carefully Matched Kernels of Corn



XMAS CARDS MAKE DECORATION FOR LAMP SHADES

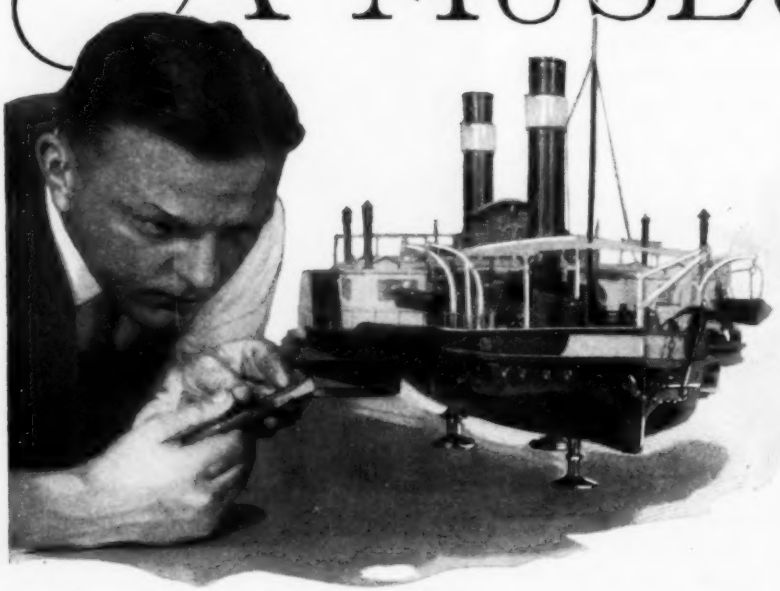
Christmas-Greeting Cards Pasted on Lamp Shade to Make a Permanent Record of Good Wishes

At last a practical use has been found for old Christmas-greeting cards usually laid aside or destroyed after they have been read. A California woman makes a permanent record of the well-wishes of her friends by incorporating them in the decoration of lamp shades, hat boxes, waste-paper baskets, card tables, and similar objects. Several coats of shellac, applied after the cards have been pasted to the article, give a durable finish.

ARMY AIR SAFETY INCREASES THOUSAND PER CENT

In the last ten years, safety in aerial operations of the air corps has increased 1,000 per cent, the war department has announced. During the last six months of 1930, for each fatal accident, 16,903 hours were flown. In 1921, only 1,718 miles were flown to each fatality. Between July 1 and December 31 of last year, there were eleven fatal accidents and nearly half of these were due to collisions in the air, indicating that military flying is naturally more hazardous than commercial flying because many maneuvers must be executed in formation.

A MUSEUM



A THINKING creature reaching this earth from another planet would surely ask, "How did you get this way?"

What way? Up in skyscrapers, for example. And swimming in the air 300 miles an hour. Traveling over continents in swift caravans. Listening to music 10,000 miles away. Looking at moving images plucked out of space. Eating fresh food out of cans. Lighting cities at the touch of buttons.

The modern young man scarcely wonders at these performances. He grew up with them. Nothing on the street suggests that skyscrapers evolved from log cabins. Such an insignificant tool as a needle might be studied in a series of 5,000 models. Because they were not collected earlier, the complete history of the needle is still unknown.

After the needle came the sewing machine, and it liberated countless hands needed for other labor. Whole industries were built around the sewing machine. Likewise, the elevator inspired the skyscraper, much as sound broadcasting gave birth to television.

The skyscraper dream was not fulfilled until men learned to fabricate steel and build elevators. In turn, the skyscraper affects our living and thinking. It sustains that cyclops of invention, the modern city—a colossal social hunting ground. What are machines but extensions of the human arm, the eye, the ear, the nerve and the brain? Machines take roles in politics, economies and international law. Whitney's cotton gin, demanding quantities of cheap labor, is said to have been the real cause of the Civil War.

The absorbing story of man's rise to technical supremacy remains to be told. In Chicago, a group of earnest men labors at this project with the thought of resurrecting a buried romance and giving it substance in the form of a museum. The building for this institution nears completion in Jackson park, on the site of the old Fine Arts building, left from the Columbian exposition of 1893. To make this structure suitable, the city of Chicago is spending $5,000,000 as against an initial endowment of $3,000,000 from Julius Rosenwald, philanthropist.

Among the exhibits which Waldemar Kaempffert, the director, is intending to build, is a series showing the gradual transition from such simple tools as the club and ax to the modern steamship and locomotive. Essentially, they will show a

COMES TO LIFE

history of the application of power, too. From the use of simple hand tools, man began to impress the service of domestic animals. Then he evolved the hand-power machine, followed by such simple contrivances as could be operated by animals. Then came machines run by water power, wind, gravity, and others operated by steam and electricity.

Stressing human, rather than scientific values, the Rosenwald museum will superimpose upon this strictly technical exhibit a social and economic interpretation. Various exhibits will compare the civilizations of modern cities with those of ancient Greece. The average free-born American citizen commands the equivalent of fifty slaves. In the times of Pericles, a Greek freeman commanded the services of only five slaves, the equivalent of only half a horsepower. In contrast to this, put the case of a modern flourmill producing 20,000 barrels of flour a day. And a steel mill or automobile factory employe may command the energy of about 10,000 horses.

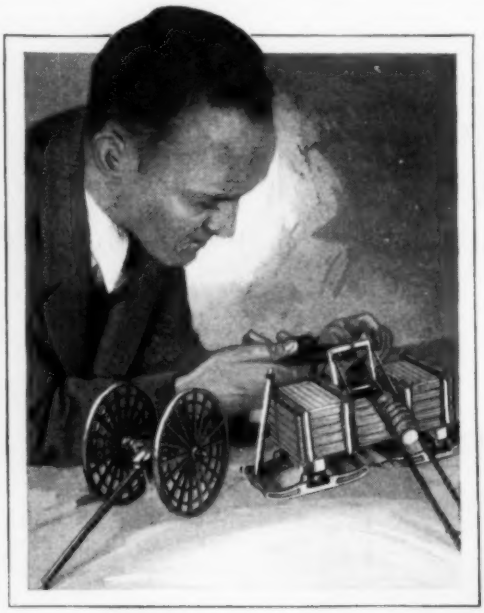
Completing Accurate Model of Sailing Vessel, and a Tiny Steam Winch

What does all this mean? Suppose we deprive man of his powered tools and compel him to produce by brawn and muscle what he produces today with machinery. Harness him to shovels that gouge at cliffs, make him pull trains, lift the loads of derricks, push freight up inclines or swing hammers weighing tons. England would have to support a population thirty times as great as it does today, and the United States would have to support one sixty times as numerous, in order to maintain the prevailing standards of comfort. We would have no time for recreation, and our working day would surely double in length. It is doubtful whether civilization could support its present population were it deprived of machinery. Within the first month, one fourth of the world's population would suffer great hardship. And at the end of the first year, more than half of us would be dead.

"Consider the typewriter," Kaempffert said. "We will have about twenty such machines to show their evolution. But

what is the social significance of a typewriter? It placed women in offices, gave millions of them jobs. Similarly, with Watt's steam engine. We will explain and have this engine working. We will stress the point that this engine created the factory and mass production.

"Electrical-power stations are now interconnective. We are in the age of 'super-power.' The Pacific coast is one power pool; the middle west another pool, and so on. Energy is free. It can be carried to the most remote places. We concern ourselves now with coal, land values,



labor supplies and transportation.

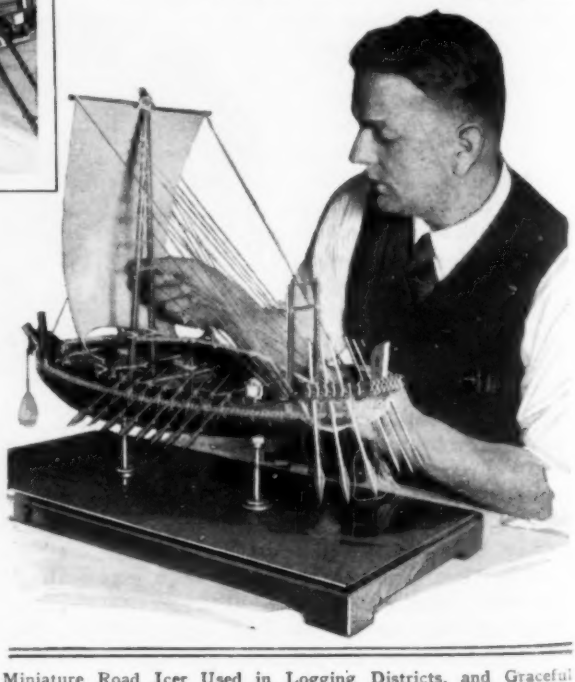
"A tremendous social disturbance is now going on as a result of the invention of the dynamo. Power pools have made it possible for industries to invade the small town. Big cities have reached their peak, and in the near future are destined to lose much of their industrial importance.

"Industry has made possible the stabilization of prices and the warding off of starvation. We have never had famines in America. They occur only in the Far East, where there are few inventions in use. To me a locomotive means more than an engine on wheels; it is a thing which places breakfast on a table."

The director pointed out what he considers a great advantage of the industrial museum over any other type of museum. In an art museum, for example, an original is sought after most. But the technical museum does not suffer much because it lacks Stephenson's "Rocket," for example. "It follows," he said, "that a technical museum can always be more coherent and systematic than any art museum. An exact replica of the 'Rocket' engine will teach all the original can."

From the experience of similar European museums, one million people are expected to visit the Chicago institution annually. It will be a new adventure for Americans. Visitors will be encouraged to work the various machines by pushing buttons and levers. One hundred moving-picture projectors will give one-man shows of such events and machines as cannot be brought under a roof.

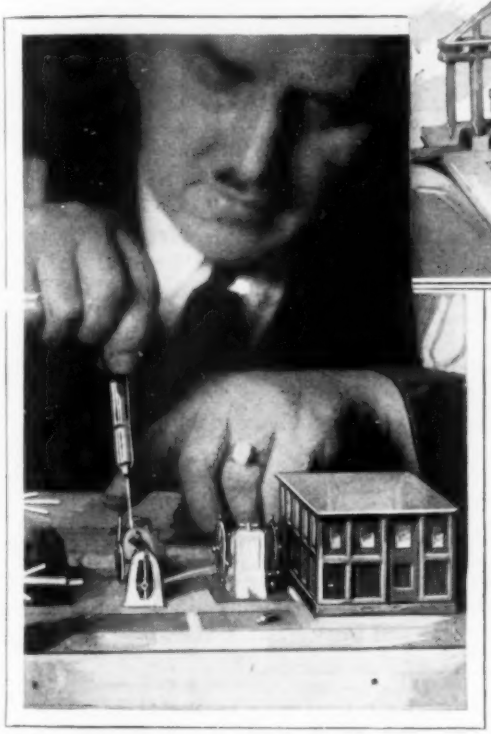
If interested in the development of sleeping cars, the visitor will be asked to lie in the earliest type of rolling bed known, and he will be given a shaking that will correspond to the shakings his



Miniature Road Icer Used in Logging Districts, and Graceful Model of an Egyptian Galley

grandfather received while riding in the same contraption. Then he will be asked to try a more modern type, the first sleeping car with lights and bed clothing. Thereafter he will go into the latest type of Pullman and be asked to relax on the yielding cushions. All the while, he will hear the grinding noise of wheels beneath his feet, the click of rails, and from the window he will see bits of scenery flying by.

There will be models of ships built to scale in faithful detail. Many of these are now under construction in the mu-



Ancient Type of Bridge, and Close View of Accurately Made Fittings for Model Sailing Vessel

seum's own shops. Others are being made abroad and by American manufacturers. A craftsman may work months and months on a miniature bridge or ship, and the cost of one model may reach $10,000. Parts of the ship models' superstructures are goldplated, to ward off rust and corrosion. When the museum is complete, it is estimated that its collection will number 60,000 objects, ranging from a full-size locomotive and section of a coal mine down to things invisible to the eye.

Because of the sentimental value, an earnest attempt is being made to collect the original masterpieces of invention. Concerning Stephenson's "Rocket," Kaempffert said the Chicago museum has ordered the construction of a full-size replica which will be more accurate in detail than the original "Rocket" itself, owned by the Science Museum at Kensington. Since the "Rocket" of 1829 became standard practice in locomotive design, it was very necessary that the Chicago museum should have one. How can a copy be more original than the original itself? Kaempffert explained that the early locomotive builders never worked from drawings. The old "Rocket" came to Kensington in a dilapidated condition; it was partially restored, but the restorers blundered.

"We have insisted," he went on, "that the locomotive be built with the methods of 1829, and not with automatic machinery and riveters. In complying with our request, Stephenson and Company, descendants of the original firm, have discovered how the missing parts should have been built."

At least one locomotive in the exhibit will have steam up practically all the time and will pant like an engine ready to be off and away.

View of Old Fine Arts Building, a Relic of the World's Fair of 1893, before Its Restoration to House the Museum of Science and Industry

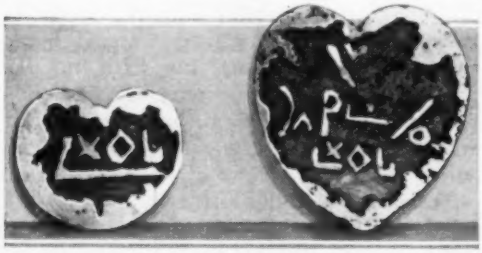
So far as possible, the Rosenwald museum will bar the glass cage. Visitors will be encouraged to feel and touch, push and pull. By pushing a button they will launch a fifteen-foot model of an ocean greyhound. The Panama canal will be represented with its locks and adjacent topography. In a miniature of the Welland canal, the visitor will be able to supervise the passage of ships through the locks. The ship exhibit, probably the most complete miniature collection in the world, will include 200 models, all on a scale of 1 to 48, so that it will be easy to judge the size of an ocean greyhound in comparison with a felucca from the Mediterranean.

The development of the paved street will be shown in a reproduction of a real street. The visitor will be led along a jungle path; then along a paved Roman road, then along a rock road of the Middle Ages, and finally over a series of modern pavements. Miniature cross sections will show how cables, sewers and tunnels are constructed beneath highways.

The coal mine will extend seventeen feet below the surface. A real mule will pull the string of coal cars. Miners and picks will show how coal is gotten out of the earth by old methods. And adjacent to this exhibit will be a modern mine, in which the visitor may operate the electrical and pneumatic machinery.

MYSTERIOUS COINS OF BRASS CLUE TO TREASURE?

Two heart-shaped coins of brass, recently found by excavators on Catalina island, have aroused the curiosity of coin specialists because the metal is unusual for such pieces. Old coins have been found on the island before, evidently dropped by Spanish or Chinese pirates. It is held possible that the peculiar marking on the coins may designate the location of hidden treasure.



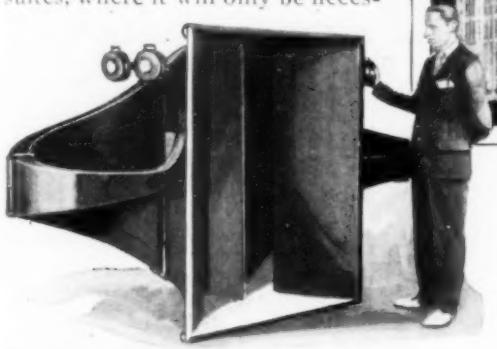
Heart-Shaped Brass Coins Found on Catalina Island; It Is Believed They May Be Part of Pirate Hoard

BRITISH INVENTIONS DECREASE

British inventions decreased slightly in 1930 as compared with 1929, when 39,898 applications for patents were made. The decline amounts to about 600, and was attributed to the world-wide depression. America and Germany were the most active foreign countries.

WIRED WIRELESS TO SERVE TWO THOUSAND ROOMS

Three triangular strands of wire, one-sixteenth of an inch in diameter, almost invisible from the street 660 feet below, will serve as the antenna system for a complicated radio hookup in New York's new Waldorf-Astoria hotel, connecting each of the 2,000 private rooms with a loud speaker. By means of a program selector, each guest will have a choice of six radio broadcasts at any time, and the same apparatus will pick up public events in the hotel itself. The outside radio programs all will be picked up on a single-strand antenna from which six large receivers will operate. In addition, there are two extra strands which will serve private receivers in 140 tower suites, where it will only be necessary to plug in an ordinary receiver, automatically providing all facilities for picking up radio broadcasts. A unilateral arrangement introduced into the antenna circuit makes it possible for a large number of receivers to operate simultaneously from the same antenna, picking up a variety of programs without causing interference. Speakers in the guestrooms will be located on tables or desks and so tuned that the volume cannot be made so loud as to annoy other guests. In addition to a telephone switchboard, large enough to serve a city of 20,000 persons, two telephone-typewriter systems will be used to report arrivals and departures of guests and for paging and transmitting messages and orders throughout the various departments. There also will be one permanent sound-picture installation in the ballroom and several portable ones.



New Waldorf-Astoria Hotel as It Will Look When Completed; Below, One of Loud Speakers in Its Radio Communication System

PLANT SUBSTITUTE FOR FLAX PRODUCES VALUABLE OIL

Safflower, which looks like a thistle without prickles and has been cultivated in India and Egypt as an oil-seed crop, is being tested in this country as a partial substitute for flax. The seeds contain a drying oil valuable in the production of paints and varnishes, and the oil cake is useful as stock feed. The United States now imports much flax seed for the linseed oil it contains, and safflower is suggested by the department of agriculture as a possible supplementary crop to flax in the northwest. The same farm machinery for sowing and harvesting other small-grain crops can be used in cultivating it. It appears more resistant to frost than flax and is well adapted to the northern great plains region.

Orange-Peeling Machine That Removes the Skin without Injuring or Crushing the Pulp

ORANGE PEELER REMOVES SKIN WITHOUT INJURING FRUIT

Squeezers and other devices for removing the juice from oranges have long been in use, but recently a machine was invented which peels the oranges without injuring the pulp or extracting any of the juice. Peeling the orange before extracting the juice makes it possible to squeeze a larger percentage of juice from the remaining pulp, because greater pressure can be applied.

TURNING FLOWERPOT STAND HELPS PLANTS GROW

So that pots can easily be turned and all sides of the plant may be exposed to the sun and thus promote growth, a revolving holder has been introduced. It is simply a water-tight metal saucer, mounted on a ball-bearing base. Even large pots can easily be turned and without damage to shelves or tables. In case the plant is in a jardiniere requiring no saucer, the unit is simply turned upside down to form a suitable base.

POOLS OF OIL ARE NURSERIES FOR STRANGE FLY SPECIES

Despite the fact that oil is usually fatal to most insects, one strange species of fly spends its infancy at the bottom of oil pools. It answers to the imposing name of "Psilopa petrolii," and is found in parts of the California oil field. Its larval life is spent in shallow pools of waste oil, left after refinery processes have removed the more volatile materials. It comes to the surface to breathe, protruding a tube to obtain air, then submerges again, feeding on the remains of other insects in the oil.

STEEL DRUM WITH LOCK HEAD SIMPLIFIES SHIPPING

Locked without the aid of tools, screws or bolts, the head of a steel shipping drum now on the market can be tightly closed or opened in a few seconds simply by moving a lever on the head. When so capped, the drum is air, gas and liquid-tight, preventing losses by leaks or evaporation and keeping out foreign substances. A composition gasket, secured to the head, is wedged tightly against the side of the drum when the locking lever is thrown to the proper position. Once closed, the drum cannot accidentally fly open, and there are slots for receiving a car seal for protection against tampering in transit. Besides affording additional protection to the contents of the drum, saving time and trouble in preparing the shipment, the locking drumhead enables easier cleaning and re-use of the container, and simplifies inspections.

SUBMARINE FOR POLAR TRIP TO BORE THROUGH ICE

Upper Left, Submarine Fitted for Trip to Pole under the Ice; Note Framework Like Inverted Sled Runners for Ice Protection; Above, Ladder That Will Be Used by Diver; in Circle, the Ice-Cutting Disk

Dog sleds, ships and airplanes all have carried their parties of explorers to the Arctic, and, now a north-pole voyage by submarine is being arranged, the sub-sea craft intending to chart its course through the ocean beneath many feet of ice. This underwater trip to the pole is planned by Sir George Hubert Wilkins and his associates, who have fitted a former navy submarine for the journey. The "Nautilus," as the altered craft has been named, bears little resemblance to the ordinary submersible. Across its top, from end to end, extends a curved steel framework giving it the appearance of an inverted sled, and where the conning tower used to be, a huge steel tube now protrudes. This telescoping tube contains a "cat-head" drill in its top which is expected to be able to bore through thirteen feet of ice, thus providing an exit for the crew in case the boat is trapped or disabled in the polar regions. The ice-breaking drill is mounted in a tube which in turn is contained in another tube to keep the structure water-tight. When traveling under ice, the tube will be retracted, its lower end resting on the bottom of the hull, and its top flush with the curved sled-deck. The inverted runners allow the craft to rise to the ice layer and travel in this position without damage, the runners protecting the hull from the ice. Shafts extend through the ice-boring tube, and these rotate the entire head or cap, and also revolve the disk-shaped cutter which extends beyond the edge of the tube, so a hole, slightly larger than the conning tower, can be made. It is estimated the drill will penetrate eighteen inches of ice a minute. Once the ice is punctured, the cap can be removed and the crew can climb out. Two smaller drills, capable of boring through ice 100 feet thick, are mounted aft. These are for the purpose of drilling through nearly any thickness of ice that may be encountered, to obtain air. Thus the crew, even under 100 feet of ice, still will be able to breathe pure air.

OVER THOUSAND U. S. AIRPORTS WORTH HUNDRED MILLION

Some idea of the expansion of aviation is gained from department of commerce figures showing the United States now has 1,113 airports valued at $115,068,500. Improvements in progress call for additional expenditures of $20,225,000. There are 564 commercial airports and 549 municipally owned fields, New York leading the states with an investment of 19,890,000 dollars.

Jumping into the

Leaping by parachute into the heart of dense, tropical jungle is an experience that few people would choose. But early this year an American aviator and soldier of fortune did that very thing. He jumped from a speeding airplane over Central America and descended in a parachute.

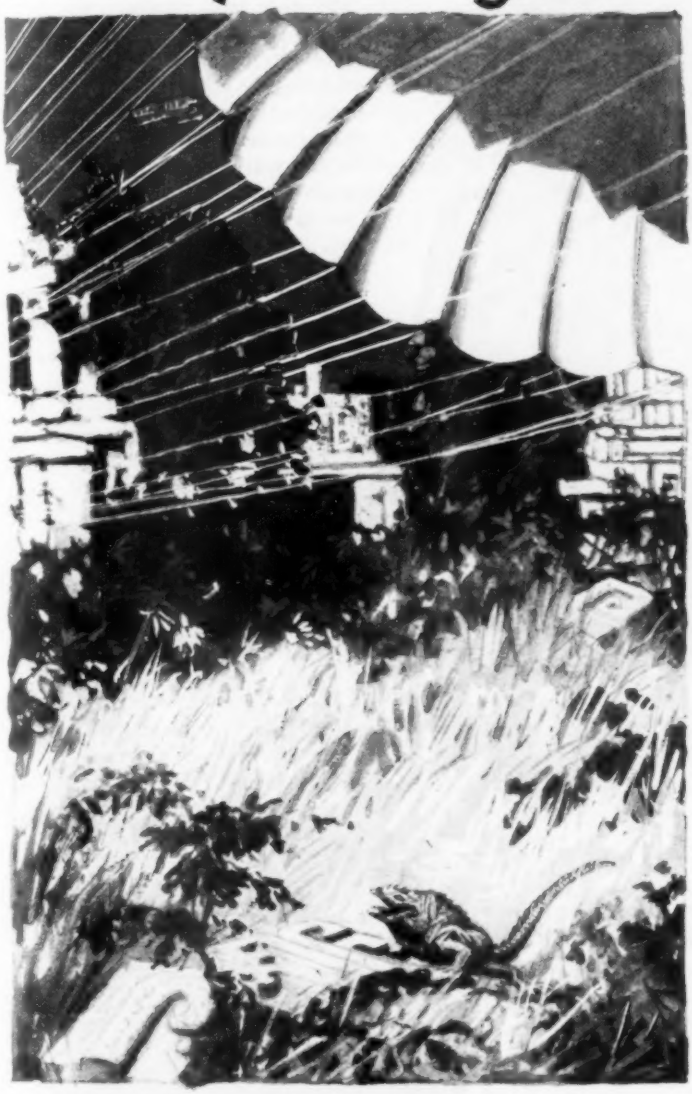
This was not done as an aerial stunt. It was a case of using the latest mechanical means to reach a hitherto unexplored Mayan city which lies beneath the tangled vines and interlocked boughs that form the impregnable jungle in the locality where the leap was made. It was a unique attempt to reach the scene of former Mayan glory and, perhaps, discover some of the secrets of this ancient civilization. And also it is believed that in some of these interior temples vast stores of gold lie hidden.

Aviation Has Opened Up a New Way of Exploration Whereby Secrets of Ancient Civilizations Are Being Revealed to Science

But making a great discovery beneath the shadows of the heavy growth of trees would do the finder no good unless he could escape the tentacles of the tropical vines and tell the world. This problem of escape is the point about such a jump which impresses most people. No medieval knight would have need of more implements for cutting than a man descending into a jungle. One or two machetes are needed for close-in work, an ax is indispensable for cutting larger branches of trees, and a gun, preferably a pistol, is a most useful weapon. Against jaguars the pistol is the best defense, and against hostile natives armed with spears and bows, it is also a lifesaver. But against huge snakes which lie in wait on overhanging boughs, the pistol is of little use. At such close quarters the machete with a sharp blade is a man's best defense.

The ex-army aviator and soldier of fortune who leaped into the jungle went

MAYAN JUNGLES



Parachute Jump Made by an American Aviator into a Yucatan Jungle to Explore an Otherwise Inaccessible Mayan City

prepared for all ordinary emergencies. It was in the fastness of Yucatan he made his descent. This is where the undergrowth is the thickest and where some of the most important of the old Mayan cities lie hidden. If these places could have been approached without prodigious labor on the ground, they would long ago have been thoroughly explored. The aviator who took the short cut by the parachute route had numerous weapons and supplies strapped to his person. In addition to weapons, he carried flasks of water and concentrated foods.

Flying over jungles is not a new experience to many aviators. Army, navy and marine flyers have often made long trips over such lands. The marines have plenty of "bush" in Nicaragua. The army and navy have plenty of jungles in the Philippines. Over all of this sort of country the airmen go prepared for forced landings. They carry, in the cockpit of their planes, concentrated foods which are specially prepared and put up in tins; bolos; automatics; a blanket, and canteens of water. The heavy growth of trees permits a forced landing without serious effect. If a plane is "pancaked" down, the undergrowth takes up so much of the shock and forward speed that disastrous consequences purely from the landings themselves are seldom feared. But a plane afire is a terrible thing to bring down in the jungle.

There has been considerable air traffic over the Central American jungles during the last few years. Commercial air lines make regular trips over portions of bad forced-landing country. Due to the fact that a man can cut only a few hundred yards of undergrowth a day while trying to make his way to open country, forced landings there are hazardous and feared

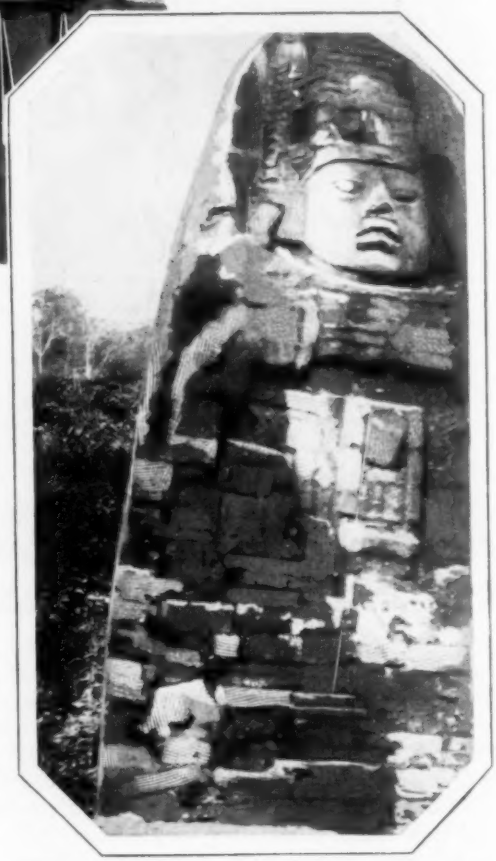
Courtesy Century of Progress

by airmen. Very few will jump to avoid such landings over jungles. Most of them declare they would go down with the ship and take a chance of hitting a soft spot.

One American army aviator had a harrowing experience a few years ago while flying over Central American wilds. He was flying at about 10,000 feet in an amphibian, and dusk was coming on when his engine began to miss. Looking below, he saw a beautiful little round lake. He looked at it carefully and decided to take a chance on it. Accordingly, he began to spiral. Down he came and as he approached the water he noticed the air getting hotter. By skillful maneuvering, he managed to set the plane down in the little lake. But the spray from the hull came up into his face—and it was hot!

He was thoroughly frightened and at once began to take stock of his surroundings. In the gathering darkness, he saw high walls surround him and, at various places on the lake, little spots of smoke or steam shooting up. At once, the terrible fact struck him that he had landed in the crater of a volcano. And a volcano not yet dead at that. The hull of the plane sank deeply into the warm water and with a missing motor and high sheer walls all around, there was not a chance of getting out immediately. Needless to say, a most uncomfortable night set in for that aviator and his mechanic.

They could find no place where they could pull to a shore and anchor. The steep walls prevented that. They stuck it out until morning and then



Members of Chicago World's Fair Expedition at Work on Drawings of Ruins at Uxmal, and Mysterious Sphinx

repaired their motor. Before taking off, they saw human figures wave to them from across the lake. They taxied over and found that a narrow trail led from the rim to the water, and some natives had come down to see the plane. After trying in vain to talk to the natives, the airmen let the motor full out in a circular take-off. The plane was lightly loaded with gasoline by this time, and it managed to stagger into the air. After two sickening spirals the southern rim of the crater was cleared and the airmen headed for the nearest seacoast. Later they learned that this volcano, which had been dormant for many years, was beginning to show signs of activity.

A peculiar, but quite natural thing in connection with seeking lost Mayan cities by airplane, is the fact that high-flying airplanes do not disclose the ancient sites to the observer. So thoroughly has the jungle conquered

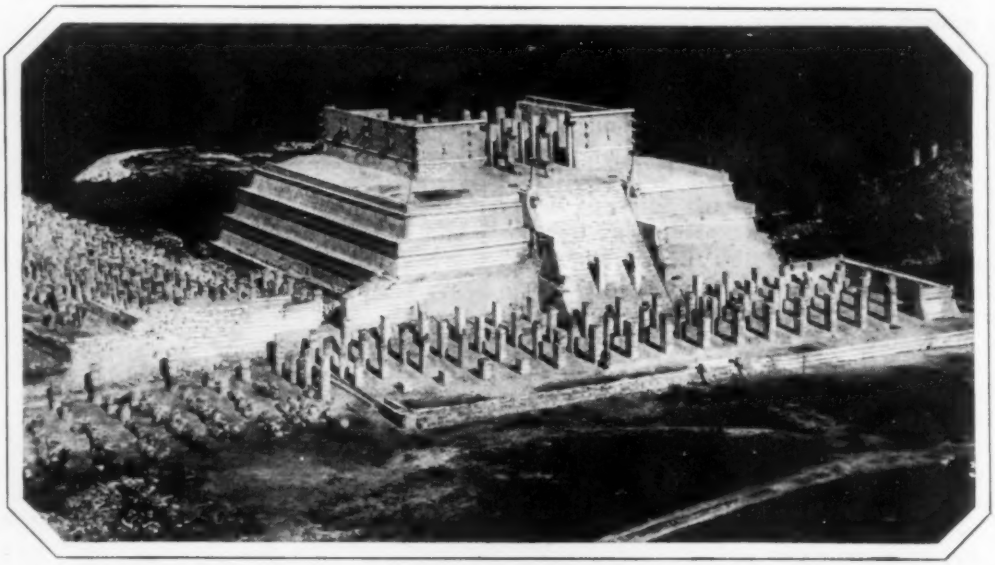
Courtesy Century of Progress

the old cities and temples that, from high in the air, the jungle looks uninterrupted. But down closer, a spot of vegetation greener than the rest, with a faint sign of straight lines prevailing in the vicinity, usually indicates a hidden city.

The place where the soldier of fortune descended in a parachute was apparently deserted. But beneath the dense bushes almost anything may exist. The old city was carefully studied from the air. It was considered one of the most important places of all the undiscovered sites. One of the best ways of detecting the Mayan cities is to fly very low and watch the horizon for high points. The temples and other buildings are often some 200 feet high. This is higher than most of the jungle growth, and the ruins, vine-covered though they be, stand up from the surrounding landscape.

One of the secrets that scientists hope to uncover in the country of the Mayas is some clue as to where the ancient civilization got its start. Many believe

Ancient Ruins at Uxmal, and Former President J. M. Orellana of Guatemala and Party About to Take Off



Where Early Inhabitants of Western World Bowed in Worship; Temple of the Warriors at Chichen-Itza, Yucatan; the Temple Proper Rested on a Base 136 Feet Square

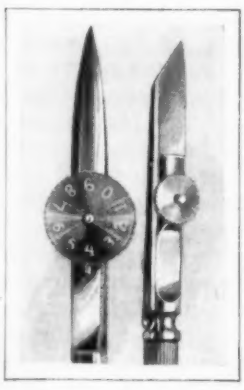
that there was a continent "Atlantis" which had a high culture and that the Mayas were a part of that civilization. If any light can be thrown upon this, it will explain the origin of ancient Egyptian and Greek legends.

One of the greatest of Mayan centers was Chichen-Itza. It covered some twelve square miles and had 250,000 inhabitants.

It was a city of palaces and temples, just one of which, if built today, would cost $32,000,000, it is estimated. It was built without beasts of burden or wheeled vehicles.

MICROMETER GAUGE FOR PEN MAKES RULING EASY

Pens with micrometer adjustments now can be obtained for fine ruling work. The adjustment screw has twenty divisions used to set the pen at any predetermined distance, each division of the micrometer equaling approximately three-thousandths of an inch. This makes possible the exact determination of the size of the line used, without careful comparisons or guesswork. The scissorlike motion of the pen leaves allows the instrument to be cleaned easily. Another pen with a similar attachment is used for making fine lines only.



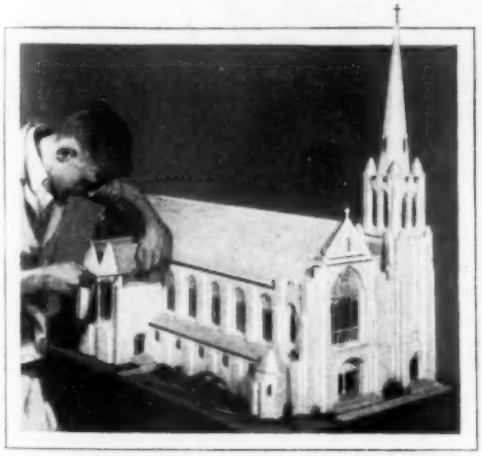
SMALL CHANGES IN SUN'S HEAT AFFECT EARTH'S WEATHER

When it radiates heat and light to the earth, the sun also broadcasts information that can be employed to foretell the weather, and eventually the weather may be forecast weeks, months or even years in advance. This is the view of Dr. C. G. Abbot, secretary of the Smithsonian Institution, who declares that the weather appears to be governed by variations in sun radiation. Doctor Abbot compared temperatures, as officially recorded at Washington, with changes of intensity in sun radiation as obtained from daily measurements, and found solar variations produce certain changes in weather conditions. Average fluctuations in mean temperature of five degrees Fahrenheit were found to correspond to solar changes averaging only eight-tenths of one per cent. After testing his theory that major changes in

weather are due to short-period changes in the sun in widely separated localities, he decided that the sun's rays do not act directly on the earth's atmosphere, some of the large effects occurring two weeks or more after the solar cause ceases to operate. Doctor Abbot suggests that the circulation of the atmosphere is changed by the sun's variations, the radiation absorbed by the atmosphere tending to displace the centers of great cyclonic whirls, and hence to alter wind direction at various places. He suggests that solar variations may be particularly effective at certain parts of the earth where weather is "born." Long swings of variation in the sun's heat, extending over many months, also were discovered, and these give promise of very long-range forecasting.

PRESSED-WOOD CHURCH MODEL SHOWS BOY'S SKILL

Architects, artists and others have been admiring a model of St. Cecilia's Church, Cincinnati, executed by Robert J. Schultz, fifteen years old, of Oak Park, Ill. The model is carefully designed from architect's drawings and is a faithful replica of the original both as to exterior and interior. It is made of a pressed-wood material in several layers. The windows



© The Masonite Corporation

Pressed Wood Model of a Church Made by Fifteen-Year-Old Boy; The Interior Is as Carefully Made

are of mica which has been painted to represent stained glass. The window frames are of balsa wood, hand-carved with safety-razor blades.

Coal-Truck Body Elevated and Tilted to Allow Loading of Bags through Chutes in the Sides

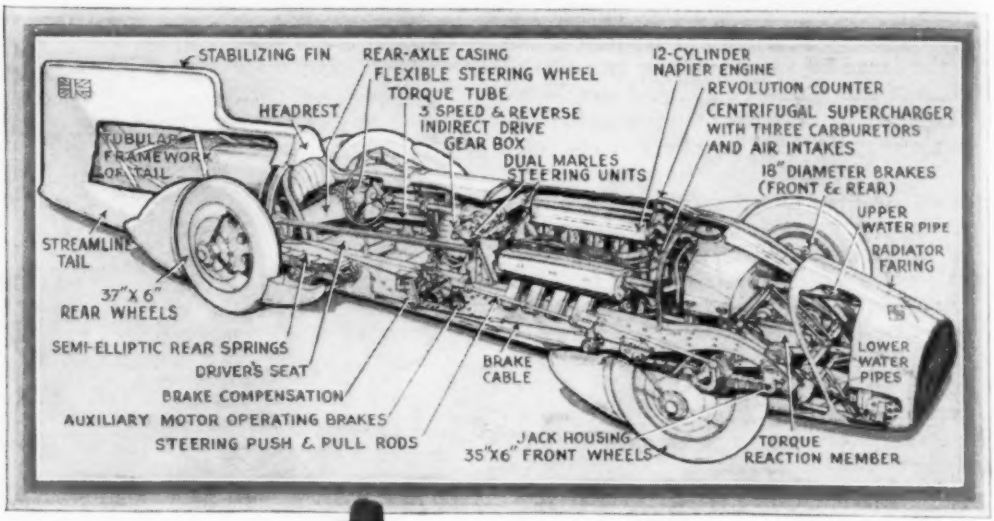
AUTO LIFT BODY WITH CHUTES SPEEDS COAL UNLOADING

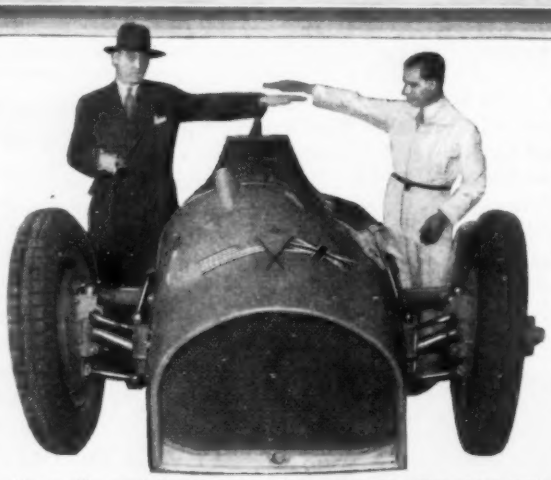
Adapted especially to handling coal, a truck body for the Chevrolet chassis can be elevated and tilted and has chutes under which bags of coal may be loaded for carrying into the cellar. Extension sides are provided for hauling larger loads, as of coke, for instance. The side delivery permits dumping the coal without running the truck out into the street.

FEVER IN DISEASED PLANTS TRACED TO MICROBE

Plants, like animals and human beings, develop a fever when afflicted with certain ailments, and the tiny bacterium that causes rot of the roots has been found responsible for much of the trouble. Experts in Texas recently reported that the temperature of leaves on some afflicted plants was about three degrees higher than normal. Tests have shown that the germ which causes root rot does not thrive in acid soils, hence efforts are being made to raise crops that will grow successfully in ground of relatively high acidity. In the case of cotton, a way has been found to defeat the pest by speeding the plants to produce their bolls before the root-rot germ can do its damage.

FOUR MILES A MINUTE—AND HIGHER SPEED IS SEEN





Above, Unusual Construction Features of the "Bluebird II"; Below, Head-On View; Note How Low the Body Is

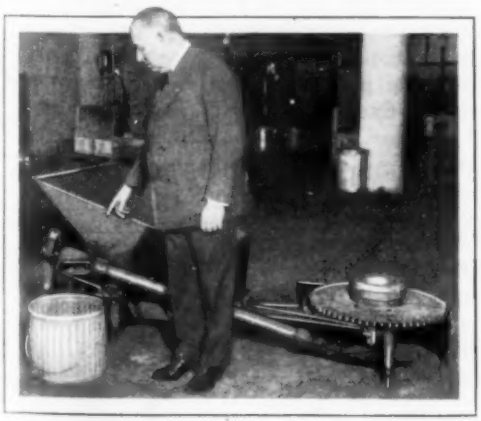
Although he is the first man who ever has traveled more than four miles a minute in an automobile, Capt. Malcolm Campbell, British racer who recently broke the world's speed record at Daytona Beach, Fla., is not satisfied with his mark and predicts even higher speeds for the future. Even his own powerful "Bluebird II," in which he traveled 245.733 miles an hour for the official record, is capable of doing 260 miles or better under favorable conditions, Captain Campbell believes. In fact, on his first run over the two-way course, his 1,450-horsepower machine did better than 246 miles an hour, despite the fact that the beach was not in the best condition, and visibility was poor. On the return trip, the speed was about two miles less, the two being averaged for his record which beat that of the late Sir Henry Segrave, set in 1929, by over fourteen miles an hour. After spending more than a year in careful preparation, the British driver required less than five minutes to establish his record, roaring twice over the ten-mile course and through the measured mile without a stop. The engine which set the new mark is probably the most powerful ever constructed, although it weighs only 1,140 pounds. In spite of its tremendous power output, the twelve-cylinder engine is only a little over five feet long, about three feet wide and three feet high. Some idea of the driving of such a racer may be gained from the fact that Captain Campbell shifted from low to second gear at seventy or eighty miles an hour, and from second into high at 125 or 130 miles an hour. The streamlined car had a stabilizing fin at the rear to help control it, and other features included use of the Handley-Page slotted-wing principle to reduce air resistance, separate cowling of the radiator, offsetting of the gearbox, propeller shaft and final drive, and tubular body construction to afford the driver protection in case of an accident.

COINS WRAPPED AND COUNTED BY MACHINE

Coins now can be wrapped and counted in a single operation by simply dumping them into a machine that is being used for this purpose by banks and other business concerns in Europe. The money is shaken out on a table and pushed into the counter, which shows the total of coins handled on a control dial so that, at any moment, the operator knows the number counted. As soon as fifty coins have been tabulated, the wrapping device begins its work automatically, the counter continuing operations. The coins are wrapped in such manner that the first and last remain visible, although the roll cannot be opened accidentally. To set the machine for handling coins of different size, it is only necessary to move a small lever. The apparatus is operated by a small motor and handles from 600 to 800 coins a minute.

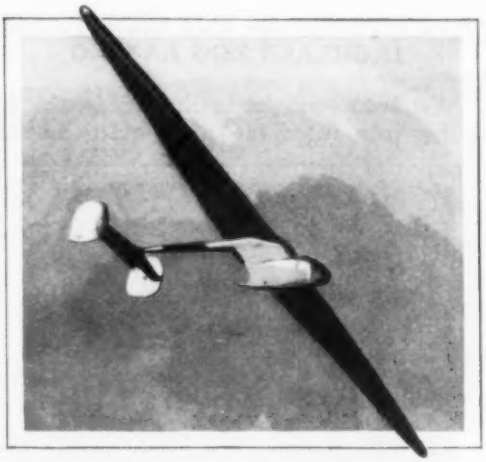
WORM REMOVES THE ASHES FROM FAMILY FURNACE

Furnaces now can be tended automatically with a stoking apparatus that also removes the ashes. A Cleveland man has made a soft-coal stoker for use in the home, a part of the device being an "ash worm" which gathers up the ashes and conveys them from the ashpit to a near-by container, thus making operation of the heating plant almost entirely mechanical.



Furnace Stoker That Also Contains an "Ash Worm" Which Removes Contents of Pit Automatically

¶Triple-fast films have been developed for the movies.



Sailplane with Wing Span of Over Ninety Feet; the Wings Can Be Folded Back for Transporting

BIG SAILPLANE HAS WING SPAN OF OVER NINETY FEET

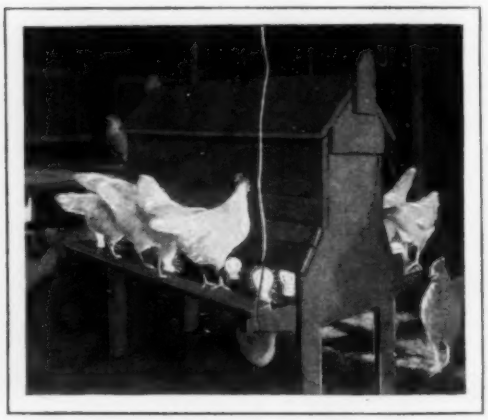
Gliders, like airplanes, are growing larger and larger, and a sailplane with a wing span of more than ninety feet was constructed in Germany recently for the Austrian glider, Robert Kronfeld. This ship, with a wing area greater than that of most motor-driven planes, can be transported easily, as the wings can be folded back onto the body in sections.

DOG AND CAT OF SAME FAMILY FOSSIL RECORDS SHOW

Dogs and cats are descendants of the same ancestral race, findings of the late Prof. W. D. Matthew, of the University of California, seem to indicate. They separated many thousands of years ago, long before the ice age, and since that time, the dog has had an especially interesting history. Its remote ancestors were small, not much larger than a fox, and had short noses. Later, one line developed size, a surviving family being represented by the bears. One of the species now extinct was even larger than the bears of today, but was quite like the dog in its other characteristics. The smaller branch of the original family developed into the dogs, wolves, foxes, and other like animals, of the present. The domestic dog of today is probably a descendant of the wolf or of the wolflike wild dog of the ice age.

FOOTLIGHTS IN THE HEN HOUSE INCREASE EGG LAYING

Artificial sunlight in simplified form is being introduced into the poultry house



Hens Standing before Electric Lamps Emitting Ultraviolet Rays, to Increase Egg Production

and brooder to increase egg production and insure healthier chickens. This extra light, in the form of ultraviolet radiation, not only provides the essential vitamin D when hens cannot obtain it from ordinary sunlight, but also causes the hens to work overtime, results in firmer shells and prevents rickets in chicks. To produce these results the General Electric company has made two lights, one a sunlight lamp similar to those used in many homes, and the other an incandescent light resembling an ordinary frosted bulb in many respects. The sunlight lamp produces, inside a bulb of ultraviolet-transmitting glass, a tungsten-mercury arc rich in healthful rays. The incandescent bulb has a filament heated to high temperature and a glass that allows the short-wave light to pass through. These lamps are being used to replace the carbon-arc and high-power quartz-mercury arc lamps previously employed, the older equipment being expensive, more or less complicated and requiring the operator to wear goggles. The sunlight lamp, suspended a few feet above the floor, serves 100 chickens. The incandescent types, of 60 or 500-watt rating, are weaker sources of ultraviolet illumination and are operated for longer periods, the weaker often being used in a brooder to give heat, light and radiation. The lamps usually are placed about feeding troughs, and because the feathers do not admit the beneficial rays, the weaker bulbs are placed in trays below the feed containers, thus serving as true footlights. The equipment can be controlled to provide regular hours of darkness and light.

COYOTE BREAKS SPEED MARK IN RACE WITH AUTO

Coyotes are noted for their speed, but until recently it was thought that their best performance was around twenty-four miles an hour. It took Joseph Joffe, assistant to the superintendent of Yellowstone national park, and his car to prove that a coyote, when pressed, can run between twenty-five and thirty-five miles an hour and keep it up for a distance of nearly two miles. Joffe was on his way to the buffalo ranch a few weeks ago when a coyote, deserting its companion, instead of running off into the woods, loped along the road in front of the automobile. The animal seemed intent on giving the car a brisk race. When Joffe speeded up, the coyote speeded up. Once when the car was almost up to the fleeing animal, the horn was blown. The coyote turned, made a dash at the car, but quickly wheeled around and continued running. Close watch was kept on the speedometer, and after the coyote finally jumped out of the road, Joffe turned back and carefully measured the distance of the race. It was one and six-tenths miles, and at no time, Joffe declared, did the speedometer drop below twenty-five miles an hour. At one point, it reached a maximum of thirty-five miles.

GOLF-SCORE REGISTER FITTED TO END OF CLUB

Fitting over the end of any standard putting shaft, a golf scorer is handy to check the number of strokes when the player sinks the ball. The scorer is made of metal, the numbers appearing in a slot.

HOW RAILWAYS MAKE MILLIONS OF TIME-TABLES

"Stringing the board" is one of the interesting operations many railroads practice in preparing the millions of time-tables that must be issued each year. On a chart, lined and lettered to indicate the hours of the day and shorter intervals, the names of the stations and other data, strings are stretched between pins

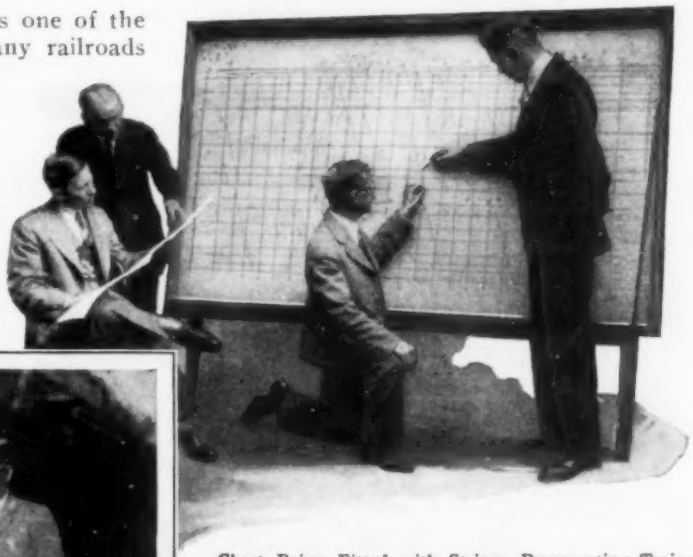


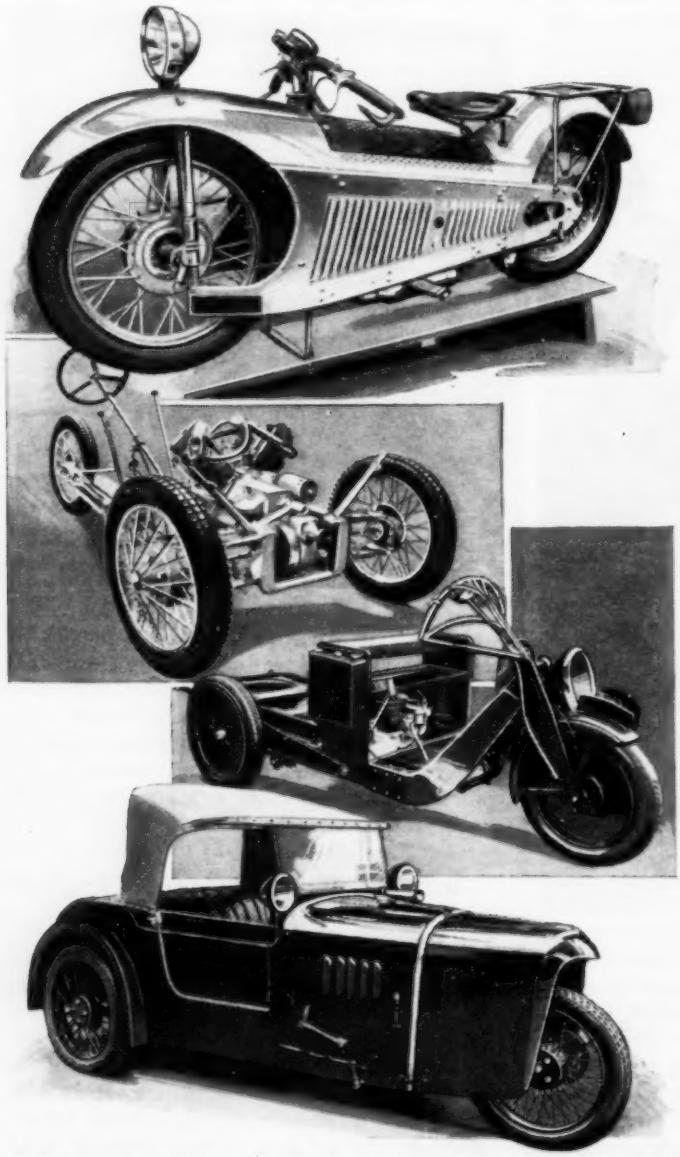
Chart Being Fitted with Strings Representing Trains Preliminary to Making Up a Railroad Time-Table; Below, Engineer and Conductor Checking Watches

to represent the trains. Those that run in one direction are indicated by strings going down the board from left to right, and those in the opposite direction by strings running upward from right to left. Points of intersection represent places where two trains would meet, and the time data show when. The schedule thus has to be arranged so that these meetings occur at places equipped to handle two trains. To allow for unavoidable losses of time, the strings are arranged on diagonals by officials of the divisions familiar with their parts of the road. In a mountainous territory, the chart strings will therefore usually be strung in zigzag fashion, while level areas are represented by strings that run straight. Some lines use colors to indicate the different trains, as red for passenger trains, black for freight and yellow for "Sunday only" or special trains. When the chart data have been obtained, dispatchers, printers, division officials, and others, collaborate to check and recheck the information until it is ready for final compilation in the time-table.

GRANITE IS FLOATED IN LIQUID HEAVIER THAN WATER

At ordinary temperatures the metal mercury is a liquid over seven times as heavy as water, but few think of it as a true liquid. Now, however, a scientist has made a clear and transparent fluid that is four times as heavy as water. It is produced from the rare metal thallium which, although a solid, is much heavier than mercury. The heavy liquid is a mixture of thallium formate and thallium mallinate, two organic acids. Granite and all of the gems, including diamonds, float in this liquid. There are several liquids heavier than water, and the floating test sometimes is used by jewelers to determine the value of precious stones. Methylene iodide is about three times as heavy as water when the chemical is pure, and it can be lightened by adding benzol.

THE LATEST IN MOTOR CYCLES SEEN IN EUROPE



A Motorcycle and Some Three-Wheeled Auto Cars, Shown Recently in Europe; Note the Streamlined Vehicle at the Top

"Tricycle" automobiles and motorcycles attracted much attention at a recent motor show in Paris where emphasis was placed on the small car and its possibilities in easy operation and economy. The three-wheeled automobiles were of two main types, with a single or double driving and steering wheel in front. The engine was of three-horsepower capacity, windshield and folding top, headlights and other details were of auto type. The distinctive features of the new motorcycle were its inclosed engine and transmission, and better streamline design.

OCEAN AIR-MAIL PLANES PUT UP TO CONGRESS

Airships, carrying tons of mail and passengers, may be speeding across the oceans within the near future as a result of a bill before congress that would legalize the ships as common carriers and authorize the postmaster-general to make air-mail carrying contracts with their operators. One line, according to present plans, would deliver letters from the United States to Europe in two and one-half or three days from the eastern coast, and to China in five or six days from the west coast. Terminals for the airship lines would be built in this country, Europe, Hawaii and the Orient, and would be used interchangeably by dirigibles of different nations. The proposed ships would carry about ten tons of mail each, but it will probably be a long time before dirigibles will be able to carry any large portion of overseas passengers. Even four dirigibles of mighty size, as many as can be constructed in the near future, could carry only about eight per cent of the first-class passengers now traveling abroad, it is estimated. Congress is also discussing plans for a huge metal-clad airship for the army, to cost

$4,500,000. It would be able to carry a 40,000-pound load from Washington to Panama in twenty-eight hours. In line with transatlantic aviation, the post office department is expected again to advertise for bids for air-mail carrying across the Atlantic by planes.

STEEL TUBING IS BEING LINED WITH MANY METALS

Steel tubing is now being lined with a variety of metals or alloys by a new process which combines the tube and its lining inseparably by fusion. It is expected that such tubes will be of great importance in the production of steel-backed bearings. The thickness of the bearing metal can be accurately controlled, and the tubes can be furnished in lengths as great as sixteen feet or longer, so that bearings of varying lengths, but with the same outside and inside diameters, may be produced from one piece of tubing. The tubes will also be useful, when lined with non-corrosive metals, for conveying chemicals that would injure the steel, for water-tube boilers and for water pipes where strength is a desirable factor.

INCLOSED HATCH ON OUTBOARD PROTECTS THE MOTOR

Outboard motorboats this year are being provided with many accessories to give more comfort and efficiency. One of these features is a hatch to inclose and protect the motor, thus getting rid of spray and eliminating much of the noise. The hatch gives the boat a runabout appearance with outboard inexpensiveness.

Inclosed Hatch over Outboard Motor Which Protects Engine and Gives Runabout Appearance

Automatic Grocery Where the Purchaser Inserts Coin in Slots to Obtain Any Article Desired

COIN-IN-THE-SLOT GROCERY SAVES SHOPPER TIME

Groceries are dispensed from coin-in-the-slot compartments in an electrically operated show case recently introduced. The customer has a clear view of the merchandise before making a selection, the articles are properly wrapped and tied for carrying, and there is no delay in waiting for a clerk. The compartments hold a generous supply of each article, so that stock taking is possible almost at a glance and renewal simplified.

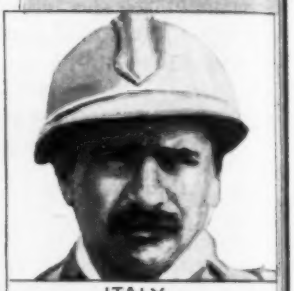
DEEP-SEA DIVERS HELP BUILD STORE IN HEART OF CITY

Deep-sea divers recently were working 100 feet under the city streets of Philadelphia. During excavations for the foundation of a department store, it was found necessary to go down more than 100 feet to reach bedrock. At one point, a subterranean stream was encountered, and the divers were called on to do the excavating in this river. They donned regular diving equipment, descended to the bed of the stream and loosened the gravel with compressed-air hose.

The Strength

RUSSIA
ACTIVE 624,000
RESERVE 4,528,000

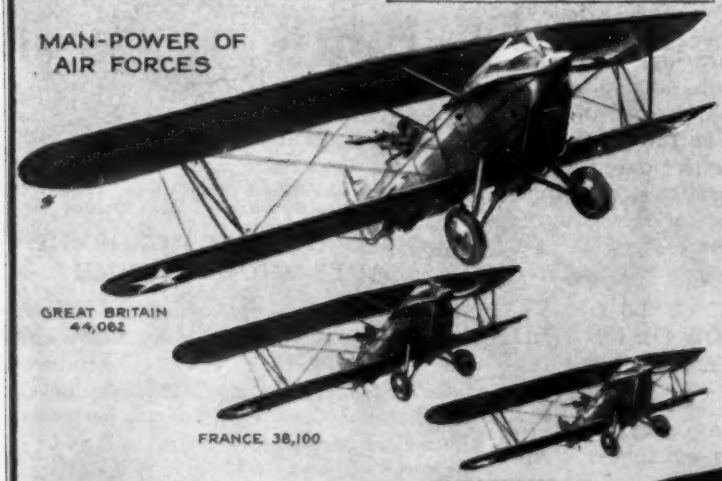
FRANCE
ACTIVE 584,767
RESERVE 5,675,561



ITALY
ACTIVE 390,334
RESERVE 5,551,450

The Armies and Navies of the World Pass in Review before Your Eyes; the Figures Given Are the Latest and Are from Trustworthy Sources; the Reserve of the Various Nations Is an Interesting, but Somewhat Loose, Classification, as This Force Has a Different Status in Different Countries; the National Guards Are Included in That of the United States; in Some of the Battleship Figures, the Totals Include the Number of Vessels Built, Building, Appropriated For, and Authorized

MAN-POWER OF AIR FORCES



GREAT BRITAIN 44,062

FRANCE 38,100

ITALY 22,980

RUSSIA 15,000

UNITED STATES 12,000 (ARMY AND NAVY COMBINED)

GERMANY ?

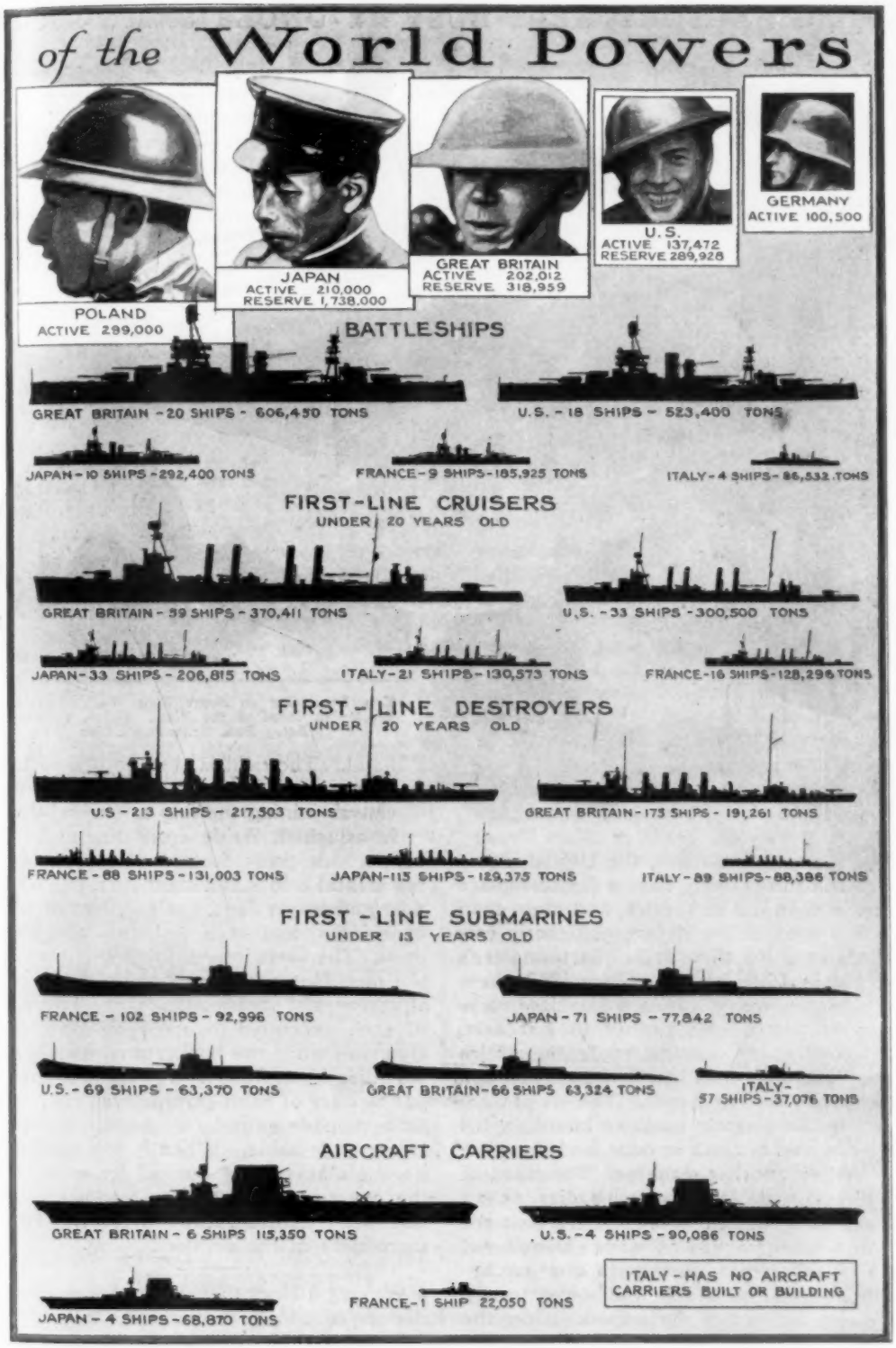
FRANCE - STRENGTH IN TANKS 2,500
A FORM OF WAR MATERIAL OF WHICH GERMANY HAS NONE

RUSSIA STRENGTH IN TANKS-250

ITALY STRENGTH IN TANKS - 250

GREAT BRITAIN TANKS 200 AND 150 IN COLONIES

POLAND STRENGTH IN TANKS-100


of the World Powers
POLAND
ACTIVE 299,000
JAPAN
ACTIVE 210,000
RESERVE 1,738,000
GREAT BRITAIN
ACTIVE 202,012
RESERVE 318,959
U.S.
ACTIVE 137,472
RESERVE 289,928
GERMANY
ACTIVE 100,500
BATTLESHIPS
GREAT BRITAIN - 20 SHIPS - 606,450 TONS
U.S. - 18 SHIPS - 523,400 TONS
JAPAN - 10 SHIPS - 292,400 TONS
FRANCE - 9 SHIPS - 185,925 TONS
ITALY - 4 SHIPS - 86,532 TONS
FIRST-LINE CRUISERS
UNDER 20 YEARS OLD
GREAT BRITAIN - 59 SHIPS - 370,411 TONS
U.S. - 33 SHIPS - 300,500 TONS
JAPAN - 33 SHIPS - 206,815 TONS
ITALY - 21 SHIPS - 130,573 TONS
FRANCE - 16 SHIPS - 128,296 TONS
FIRST-LINE DESTROYERS
UNDER 20 YEARS OLD
U.S. - 213 SHIPS - 217,503 TONS
GREAT BRITAIN - 173 SHIPS - 191,261 TONS
FRANCE - 88 SHIPS - 131,003 TONS
JAPAN - 113 SHIPS - 129,375 TONS
ITALY - 89 SHIPS - 88,386 TONS
FIRST-LINE SUBMARINES
UNDER 13 YEARS OLD
FRANCE - 102 SHIPS - 92,996 TONS
JAPAN - 71 SHIPS - 77,842 TONS
U.S. - 69 SHIPS - 63,370 TONS
GREAT BRITAIN - 66 SHIPS 63,324 TONS
ITALY - 57 SHIPS - 37,076 TONS
AIRCRAFT CARRIERS
GREAT BRITAIN - 6 SHIPS 115,350 TONS
U.S. - 4 SHIPS - 90,086 TONS
JAPAN - 4 SHIPS - 68,870 TONS
FRANCE - 1 SHIP 22,050 TONS
ITALY - HAS NO AIRCRAFT CARRIERS BUILT OR BUILDING

FLAG FACTORY KEPT BUSY BY UNCLE SAM'S ARMY

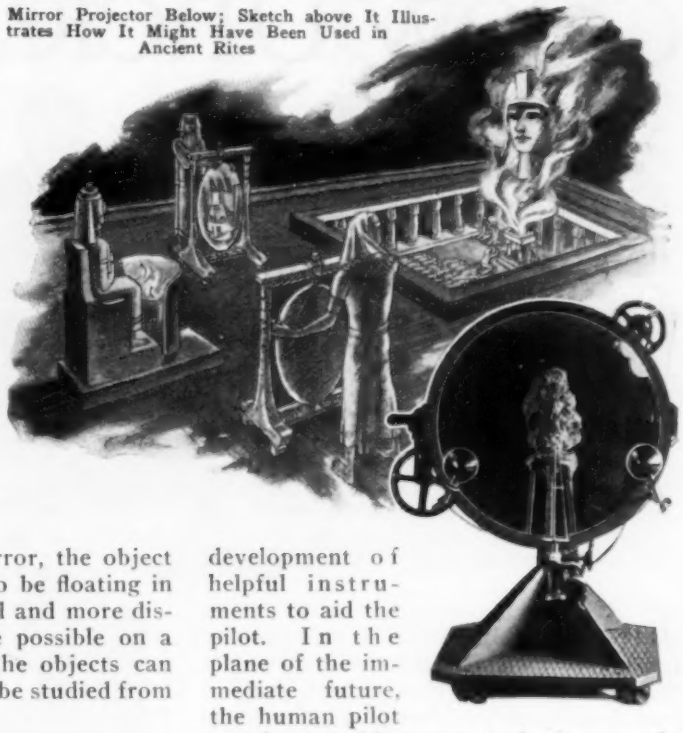
Top, Inspecting an Army Flag; Left, Attaching Staples to Head of the Flag; Above, a Modern Betsy Ross Trimming a Star

Even in peace times, the United States army requires thirty flags a day to replace those worn out in service, and more than 100 women and girls are constantly employed making them at the quartermaster's depot in Philadelphia. Since 1912, there have been twelve standard flag sizes varying in width from twenty to 1.31 feet. Originally one woman made the entire flag, but today each banner passes through thirteen different hands. The stripes are cut by an electric machine handling 100 thicknesses of cloth at once, and these are sewed on another machine. The stars, of white percale, are cut with dies on an electrically driven press. After that the blue field is marked off with a stencil and an operator sews on the stars, a star being placed on one side and sewed to one slightly larger on the opposite side, the larger star being trimmed off later by hand. The field is then joined to the stripes, and finally the heavy piece of canvas joining the flag to the halyards is attached. Aside from the national colors, this army factory also turns out regimental colors and standards, garrison, post and storm flags, ensigns, harbor and boat jacks, and even pennants and guidons. The most interesting flag is that of the president, which accompanies him on all ceremonial occasions. It is the privilege of each executive to order his own design, and while the background usually is blue, President Roosevelt chose red. These banners are of hand-embroidered silk, and each is made entirely by hand. No flag is ever cast aside. When it has outlived its usefulness, it is burned by order of the commander of the post to which it had been allotted, thus preserving the sacredness of the emblem.

¶Waving a black flag at a bull is as effective as a red one because the animal is color-blind and sees both as black.

PICTURES PROJECTED IN SPACE WITHOUT SCREEN

Mirror Projector Below; Sketch above It Illustrates How It Might Have Been Used in Ancient Rites



Designed especially for lecture and classroom use, a mirror-projector apparatus magnifies objects and shows them in three dimensions without the aid of a screen and without darkening the room. The object to be shown is adjusted on a moving holder in front of the mirror, which is concave and about two feet in diameter. Ordinary incandescent lights are played on the glass. Their illumination, reflected back up on the article, helps to reveal it more clearly. To persons sitting in front of the mirror, the object being examined appears to be floating in space in a greatly enlarged and more distinct form than would be possible on a screen. The holder for the objects can be turned so that they can be studied from all sides.

SOLDERING IRON HAS SWITCH IN HANDLE TO SAVE TIME

Equipped with two tips, an electric soldering iron has a switch in the handle so that current can be turned on or off with

Soldering Iron with Switch in Handle

the fingers, saving the trouble of pulling out a plug. This arrangement saves time and insures better work through more accurate heat regulation.

ROBOT PILOTS TO FLY PLANES TO INCREASE SAFETY

Automatic airplane flying is predicted within the near future as a result of the development of helpful instruments to aid the pilot. In the plane of the immediate future, the human pilot may have nothing more to do than to take the ship off, set his course and, from then on, save for keeping the engine in mind, he may let the ship operate itself until it comes time to land. Directional and "attitude" controls being developed by the General Electric company and the Sperry Gyroscope company are two of the important units that will possibly supplement the pilot. A sonic altimeter for use in taking off and in landing will also help. The interesting service of the attitude control is that it keeps the plane right side up and in balance, something often difficult for the pilot to do when the visibility is poor, the horizon obscure or the air currents are rough. The directional equipment is expected to operate on the principle of the compass and of radio equipment; that is, it will be governed by the earth's magnetic field and from radio beacons. The sonic altimeter tells, by means of an echo, the distance of the plane from the ground at all times, a great help in landing. It will be some time before the instruments will be given extensive tests.

How Uncle Sam

Expert Food Tasters of the United States Department of Agriculture Making Taste Tests on Samples of Cooked Meats to Determine Flavor, Tenderness, and Other Qualities

THREE men in a laboratory were crushing pods of peas in a queer contraption of wheels, pulleys and scales. One man sliced the peas in half, another placed the pods on a small platform beneath a can of mercury, and the third manipulated a lever that caused the can to descend upon the pea pod while scales automatically registered the pressure needed to smash the pea into paste.

This apparatus is being used in fixing food standards, and application has been made for a public patent on it. The chemists say that the weight needed to crush peas, beans, and similar products, is an indication of food quality. Another curious device is a set of false teeth which are made to chew beef, pork and veal mechanically so as to determine the tenderness of these meats.

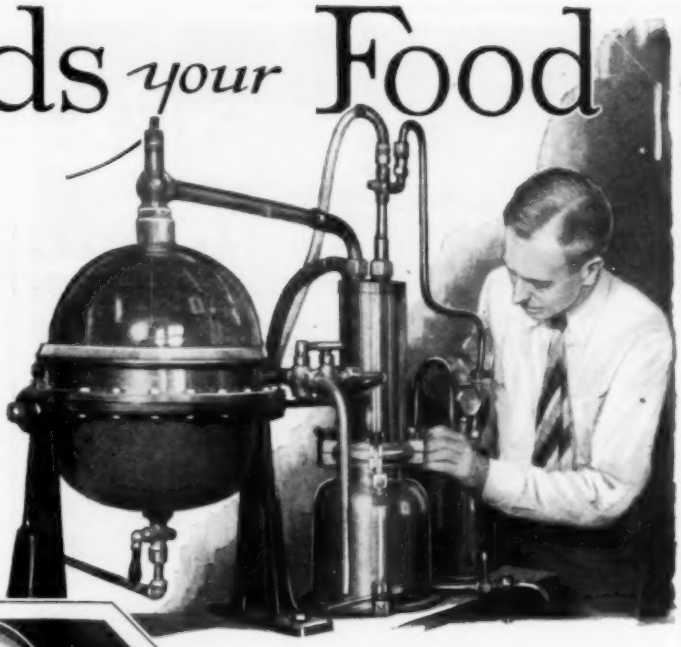
Officials of the United States department of agriculture, describing these and other unusual devices that are applied to the solution of problems which have arisen recently in the production, transportation and storage of foods—a camera for photographing the inside of eggs, an apparatus that stamps numerals in the rind of cheese, a "glass stomach" that digests food as does the human organs, an instrument that determines what odors of foods attract insects—say that these machines, strange as they may seem, are necessary adjuncts in food research.

The investigators are trying to discover whether the new methods of handling foods, such as the sand-blasting of eggs, the gassing of fruits and vegetables, artificial coloring of meats, and the congealing of fruit juices into blocks of ice, have any harmful effect on the food value of the products. They are studying a score of processes that have been developed to hasten the production of foods and to preserve them indefinitely.

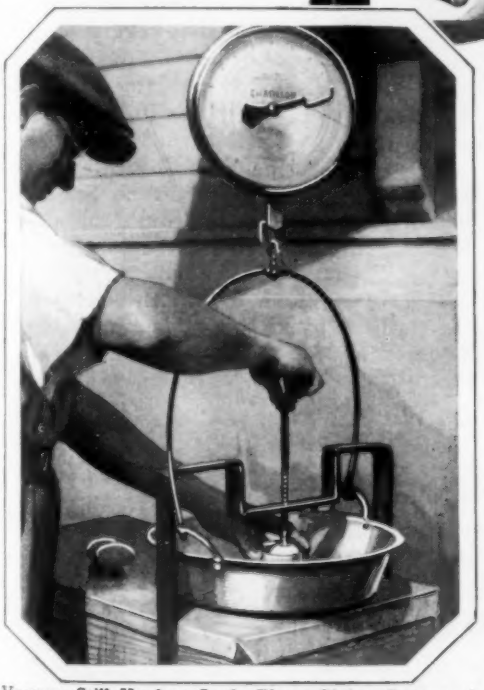
The canning industry revolutionized agriculture by making possible the utilization of products too ripe to be shipped to market fresh. Now the chemist with his solid carbon dioxide, his ethylene gas, and other chemicals, is making it possible for consumers to eat tree-ripened and field-ripened products in their fresh state, months after they have been harvested.

In Georgia, last summer, a plant that freezes tree-ripened peaches in cans turned out 700,000 pounds of that product. Approximately 100,000 barrels of cherries were frozen-packed in Wisconsin. Factories have been opened in Florida and California where the juice from cull citrus fruits is frozen. Quick-frozen meats in package form are available now in all large cities.

Guards *your* Food



In New York City, recently, 200 representatives of industries interested in the production, transportation and distribution of foods sat down to a luncheon of fresh fruits, vegetables and meats that had been produced six months before, but whose qualities of "freshness" had been remarkably preserved by various processes of gassing and freezing. These food specialists declared that the new quick-freezing processes, whereby fresh foods are congealed under temperatures as low as fifty degrees below zero, will reduce food costs through the use of products that otherwise would be wasted on the farm.



Vacuum Still Used to Study Flavor-Giving Content of Fruits, and Testing Strength of Eggs in Shell

These new methods of food handling are of such importance and are being developed so rapidly that the United States bureau of chemistry has temporarily laid aside many research projects of long standing in order to ascertain the effects of the new processes upon the nutritional value of the foods. Experiments are being made with small animals, including guinea pigs, cats, rabbits, and white rats, under automatic temperature control. Microphotographic studies are being made of bones and tissues, and ultraviolet light is being used to stimulate growth. An apparatus has been devised for preparing large quantities of vitamin-free casein for feeding experiments.

Dr. Henry G. Knight, of the bureau of chemistry, discussing the new methods of food handling, says that, "with increased facilities for the storage and distribution of food products at greatly reduced temperatures, the question has arisen whether many of the fruit juices which undergo hurtful changes on sterilization cannot be satisfactorily prepared by freezing. The greatly reduced cost of solid carbon dioxide (known commercially as 'Dry Ice' or 'Nu Ice') prompts the investigation of the possibility of preparing, shipping, and distributing fruits and fruit juices to the

Government Chemist Inspecting Meats Produced in Various Parts of the Country, in Order to Develop Better Methods of Feeding Stock

housewife in a frozen condition. There are now being kept in experimental storage several hundred packages of citrus and other products which have been frozen at temperatures ranging from thirty degrees to fifty degrees below zero. The possibilities of the different types of packages are being investigated, and methods devised for packing the products in inert gas and under high vacuum. It is believed that the next few years will show a marked change in food distribution, with frozen foods playing a very important part in household economy."

It has been learned that in seasons when pears do not soften readily, they can be softened economically with ethylene gas and thus made ready for canning. Varieties of apricots which tend to mature unevenly, one side softening while the other remains hard, are being harvested and softened by means of ethylene treatment. Ethylene-treated tomatoes take on color at a somewhat faster rate than untreated fruit kept at the same temperature and not in direct sunlight, and there is less acidity in their juice.

Soon there will be no such thing as "bad" eggs, as methods are being developed for preserving them indefinitely. The eggs revolve on a belt under a spray of fine sand, and are then dipped in oil to seal the pores. Government chemists have devised a method for coating eggs with oil under vacuum to make a better seal of the shell. Oil coating of the shell markedly inhibits shrinkage under ordinary cold-storage conditions, and application of the oil by the vacuum method results in even less shrinkage.

Waterless canning of non-acid vegetables is another innovation in food handling, and recently the food chemists have learned how to ferment turnips into "sauerkraut." The product is said to be pleasing in flavor, and, aside from general appearance, is not unlike the cabbage variety. Experiments in the bakery field have shown that as good, and often better, cake can be made by mixing all the ingredients together and at once than by following heretofore approved directions which call

Nutritional Value of Products Is Tested by Feeding Them to Small Animals in Cages

for creaming the fat and sugar first and then adding the other ingredients.

Food standards are being revised by the federal authorities in view of the development of new food-processing methods, and standards are being developed for canned products to enable consumers to ascertain on the label the quality of the goods. Canned tomatoes, peas, corn, and other products, are purchased in stores, subjected to chemical analysis, palatability and nutritional tests, and classified according to quality.

Palatability tests consist in cooking the foods under identical conditions and then having government officials eat the products and write their impressions on score cards. The chief objective of this is to discover new production methods that will shorten the producing period and yet contribute most satisfactorily to consumer taste. The products are also fed to small animals in connection with nutrition studies, and analyzed for vitamin content. While the federal officials are desirous of developing new production methods that will yield larger profits to farmers, they are mindful also of the food value of products in the interest of public health.

Injecting Chemical into Tree; Rat Used in Cottonseed-Meal Tests, and Stamping Cheese with Government Label

BILLIONS FOR GOOD ROADS

At least $3,000,000,000 will be spent in 1931 on roads by 110 nations, according to an estimate of the bureau of foreign and domestic commerce. The United States leads the parade with road expenditures estimated at $2,000,000,000. In this country, and in many others as well, the road-construction program for 1931 is being undertaken partly as a measure to aid unemployment conditions. Mexico is pushing a national trunk system, Canada has increased its road budget by $20,000,000 and Japan by a similar amount, while Argentina intends to spend $200,000,000 in building 800 miles of paved highways. In Europe, conditions are similar, Italy alone employing 60,000 men for road building.

ITALY'S FLYING FLEET CONQUERS SOUTH ATLANTIC

Top, Small Pneumatic Boat, One of the Twin-Hull Flying Boats, and Close View of an Engine

Ten flying boats of the Italian royal air force, roared into Port Natal, Brazil, skimmed smoothly down upon the water and came to rest after an 1,800-mile hop from Bolama, Portuguese Guinea. The moment was a pleasing one to Gen. Italo Balbo, leader of the fleet, and to his tired companions, for it marked the completion of the most difficult stage of the squadron's flight from Rome to Rio de Janeiro. Fourteen flying boats had started nearly a month before, two were forced down almost immediately after taking off from Bolama, with the death of four men, and two more were forced to descend upon the Atlantic after several hours of flying. They were picked up by steamers and towed to port, one being able to join the main squadron later. The flight across the Atlantic was accomplished in seventeen hours, in unfavorable weather, with poor visibility and the added hazards of heavy loads. The steamer patrol that guarded the way and helped keep in contact with the flying fleet proved to be of great aid, and the fact that General Balbo could call the roll and issue orders to his comrades by radio was another important reason for the success of the squadron's expedition. The flight is considered an important step in the development of long-distance and transoceanic flying, and shows the feasibility of formation flights on journeys of this length. General Balbo laid much of the success of the flight to his instruments. The journey began in darkness with altimeters and air-speed indicators as chief guides for the pilots.

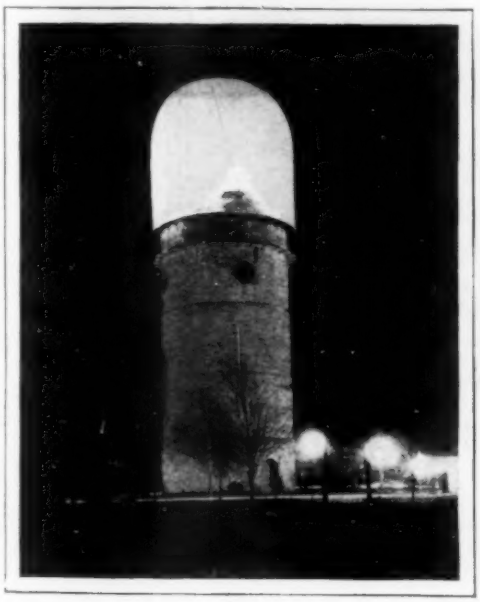
SOUND RECORD ON PAPER DISK BY PHOTOGRAPHIC PROCESS

Sound can now be recorded on cardboard paper disks through a photographic process by the use of an apparatus known as an "optophone" which has been developed in Germany. Perfect sound reproduction is claimed over the whole audible range. The records are cheap because, after the photographically produced mas-

ter disk is made, the commercial ones can be copied on cardboard very cheaply. The paper disks are durable because no needle is used in reproduction. They present a spiral of white on a dark background, the white spiral under a magnifying lens representing the characteristic variations on a film record for talking pictures. A photo-electric cell is used in producing the master photographic plate and, in playing the paper disks, converting the fluctuating waves from the microphone into electrical impulses and vice versa. Amplification and loud speaker are used.

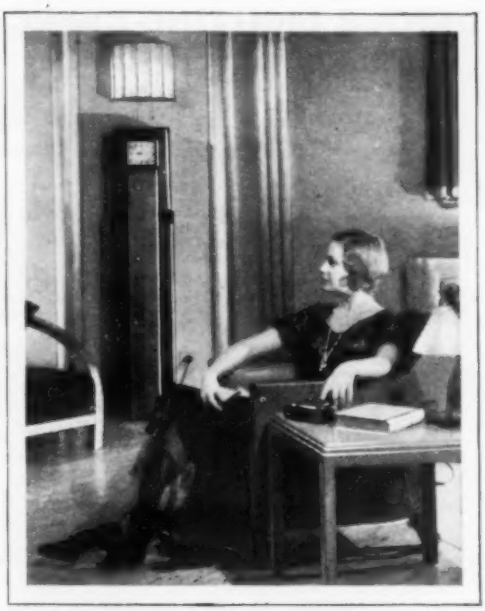
FLOODLIGHTED WATER TOWER GUIDES NIGHT FLYERS

Aviators flying at night near Ypsilanti, Mich., are guided by a brilliantly illuminated landmark, a 135-foot water tower, the dome of which is floodlighted to serve as an aerial beacon. The tower, forty feet in diameter at its base, is covered with silver-gray shingles which gleam with a sparkling brilliance under the rays of a battery of concealed searchlights. The structure, standing on the highest point in the city, is visible for ten miles when viewed from the ground, and for a much greater distance in the air.



© C. E. Lamb

Floodlighted Water Tower Which Serves Also as a Landmark for Aviators Flying at Night



Tuning In or. Program by Remote-Control Buttons; the Radio Set Is the Tall Cabinet in Left Background

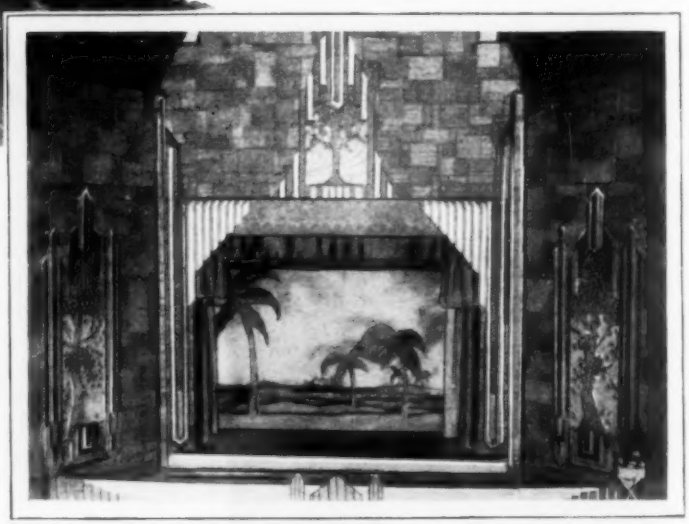
SKYSCRAPER-TYPE RADIO SET CONTAINS ELECTRIC CLOCK

Economy of space, improved tone quality and convenience are features claimed for a tall radio cabinet that also contains an electric clock and may be operated by remote control buttons. The cabinet is nearly six feet tall, but occupies a floor area of only ten by twelve inches. Aside from its handsome appearance and adaptability to the modern skyscraper note in interior decoration, its height and design have given the acoustic engineers an opportunity to improve the tone quality. The ordinary speaker grill has been eliminated from the face of the set and is placed vertically so that it is directed upward through the top of the cabinet. This arrangement provides a five-foot column of air under the speaker, an important aid to tone improvement. Controls and dials are mounted flush on the sides of the cabinet. The set is a nine-tube screen-grid superheterodyne.

¶An "ever-lasting match," invented by a Vienna chemist and recently tested with satisfactory results, can be ignited 200 times, it is claimed, although it is no larger than an ordinary safety match.

UNIQUE LIGHTING EFFECTS IN MINIATURE THEATER

Complete in every detail, even to unusual lighting effects, a miniature theater stage has been built by a Los Angeles high-school boy, mostly from odds and ends found about the home. The proscenium arch is twenty-seven and one-half by twenty-one inches, and the entire stage rests on a table. An organ with painted toothpick keys rises from the orchestra pit with a doll organist at the keyboard. A color wheel is lighted by an old bicycle lamp, a phonograph provides the organ music, tiny footlights were made from radio-panel bulbs, and gelatin used to obtain colors came from small scraps thrown away by others. The grillwork around the stage is of plastic wood, and other equipment includes projection apparatus, floodlights and a switchboard with twenty-four switches, all made of inexpensive odds and ends. The lighting system, stepped down by a transformer, uses no more current than one common light bulb. Desert and oasis scenes are interchangeable by substituting different bits of cardboard scenery, while a fishing scene is only a piece of ordinary tapestry, magically turned into a thing of beauty by the ingenious use of lights. One set, copied from a stage production, consists of a few cents' worth of tinsel which against a flimsy silver cloth catches brilliant lighting effects.



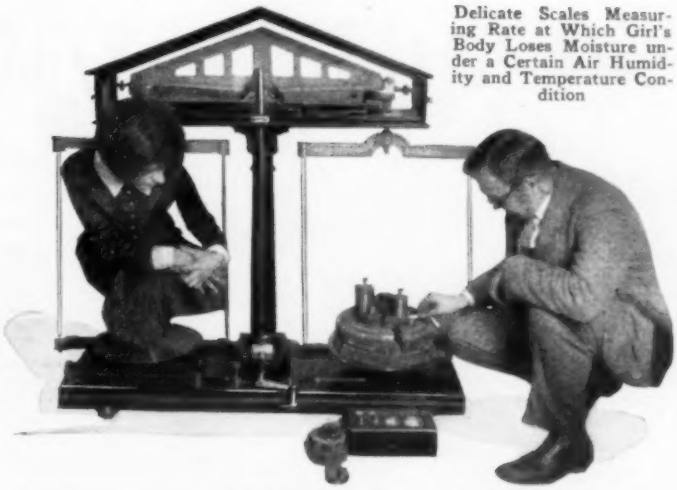
One of the Settings for the Miniature Stage Built by a Los Angeles High-School Boy, Shown, Upper Left, at His Studio Entrance

QUAKES GOOD FOR THE WORLD MAKE IT SAFER

More than 8,000 earthquakes are recorded every year and many more probably occur but are not registered, yet the world would probably be better off if there were still larger numbers of quakes, according to Dr. William Bowie, of the United States coast and geodetic survey. He points out that the more quakes there are, the less will be the intensity of any one of them, and hence likelihood of less damage. The tremors are caused, it is believed, by the breaking of rock areas from thirty to sixty miles below the earth's surface. Doctor Bowie believes that we shall have quakes as long as the sun shines and we have evaporation of rainfall.

TELEVISION GIVES QUOTATIONS TO BROKERS

Stock quotations recently were transmitted by television to brokers in the Chicago district, pictures of the ticker tape being sent as the quotations were received. In its reception, the tape resembled that which runs across the top of brokers' bulletin boards. The symbols were black against a reddish-brown background and could be seen from a distance of twenty-five feet. Radio technicians expressed the opinion that such a broadcast could be received by television within a radius of 150 miles, enabling those within such a radius to keep in touch with the stock market in their own homes.



Delicate Scales Measuring Rate at Which Girl's Body Loses Moisture under a Certain Air Humidity and Temperature Condition

DELICATE WEIGHT TESTS AID IN AIR CONDITIONING

To establish human reactions to various atmospheric conditions, delicate scales are employed in the research laboratory of the American Society of Heating and Ventilating Engineers, to determine the rate at which persons lose heat and moisture in atmospheres of various temperatures, humidities and motions. These weight tests show the relation of air conditions to health and comfort and help the engineer design air-treating systems for theaters, and other places of assemblage, where the heat and moisture given off by large numbers of persons plays an important role. In one test, for instance, a girl, normally weighing 110 pounds, was found to lose almost a gram of weight a minute under a particular atmospheric condition, this loss being due to evaporation of moisture from the body and respiratory tract.

TRACTOR CRANE LAYS PIPE TO SPEED GAS LINE

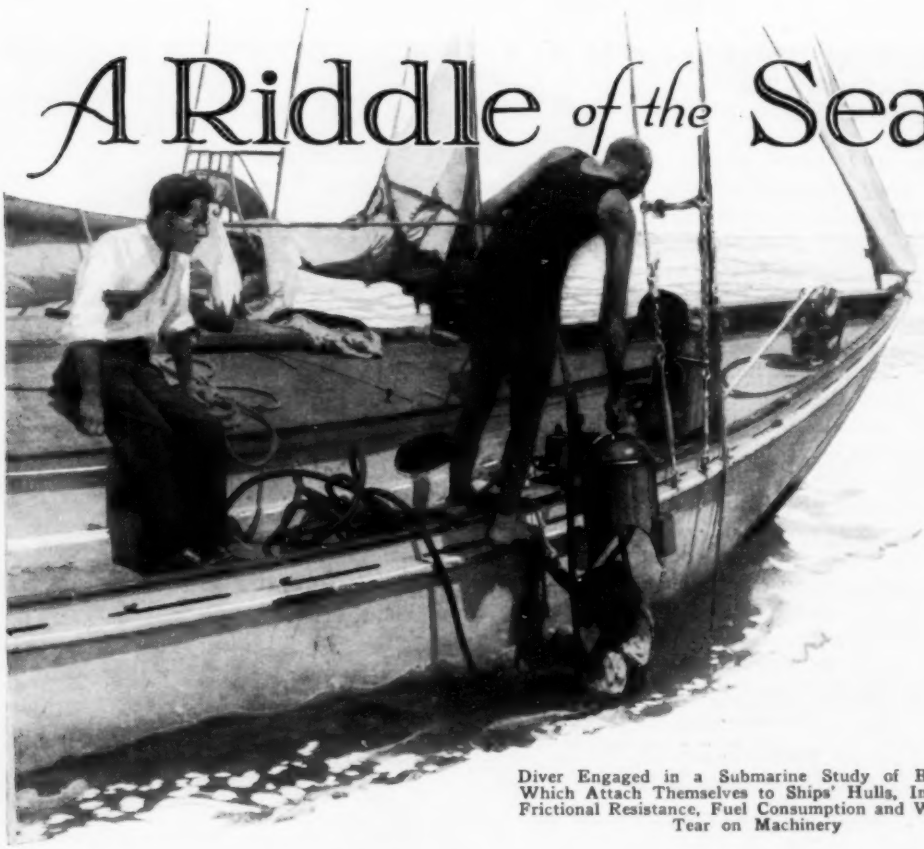
Time and labor have been saved in the laying of a gas line near Los Angeles, by using an endless-tread tractor crane to swing the heavy lengths of pipe into position. Sections, twenty-four feet long and twenty-two inches in diameter, are easily lowered into the trench so that comparatively little hand labor is necessary.

Photo Ewing Galloway

Swinging Heavy Length of Gas Main into Ditch with the Tractor Crane Which Saves Hand Labor

¶Pure cane sugar now can supply most of the ingredients for a glass of lemonade; plants now are being built for making citric acid, the active principle of lemons, directly from sugar, by fermenting the sugar solution with a special mold.

A Riddle of the Sea



Diver Engaged in a Submarine Study of Barnacles Which Attach Themselves to Ships' Hulls, Increasing Frictional Resistance, Fuel Consumption and Wear and Tear on Machinery

A RIDDLE which puzzled the Chinese, Egyptians, Phœnicians and Romans is just as much of a conundrum now as it was during the dawn days of shipping—that of preventing the fouling of ship bottoms by barnacles.

Merchant marine and naval shipping pay $100,000,000 annually in tribute to the barnacles which inhabit salt water and collect on the submerged parts of ships. Ever since the Romans devised the expedient of sheathing warships with lead attached by copper nails, maritime science has sought control measures. More than 150 devices and materials have been patented in the United States for the eradication of barnacles. None has been effective. Science, although it has learned much about the barnacle since the first Chinese junk was built some 4,000 years ago, has thus far failed in its battle to subdue this pillager. The barnacle stands unrivaled as the most persistent "Captain Kidd" of the undersea kingdom.

Barnacles are pirates in that they collect in stupendous numbers on the bottoms of ships, thus increasing frictional resistance so that from one-fifth to one-third more fuel is required to operate the vessels. The speed of the ship is reduced from one-fourth to one-third of normal velocity after drydock service. All ships that sail the seven seas have to be drydocked once every six or eight months to have the barnacles scraped by hand from their hulls—a slow, laborious and expensive process. When the barnacles are detached, the paint comes with them. This involves painting the ship bottom again, and additional losses are caused by the ship's enforced idleness.

Take the "Leviathan," for example. That part of her bottom which is exposed to barnacle attack has a surface of more than one acre. At least ten days in drydock are required to scrape off the accumulation of barnacles and to repaint the hull. The drydocking cost alone is $50,000. During that interval, the famous liner, if in service, could make one round trip

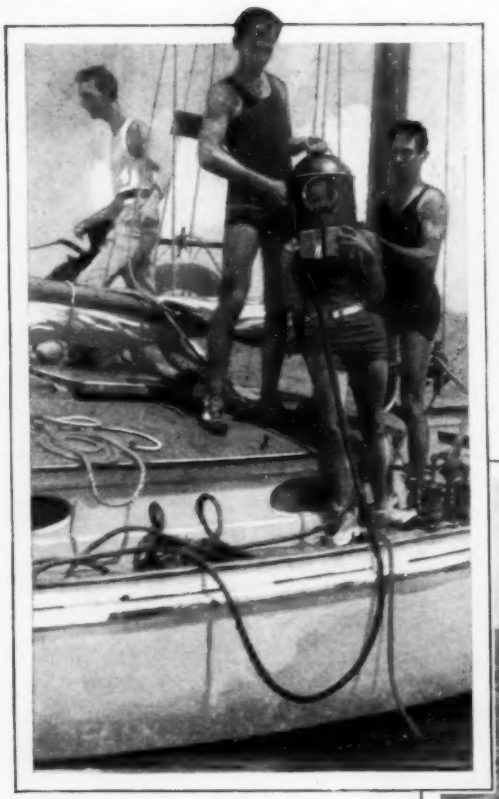
—Still Unsolved

across the Atlantic, carrying her passenger capacity.

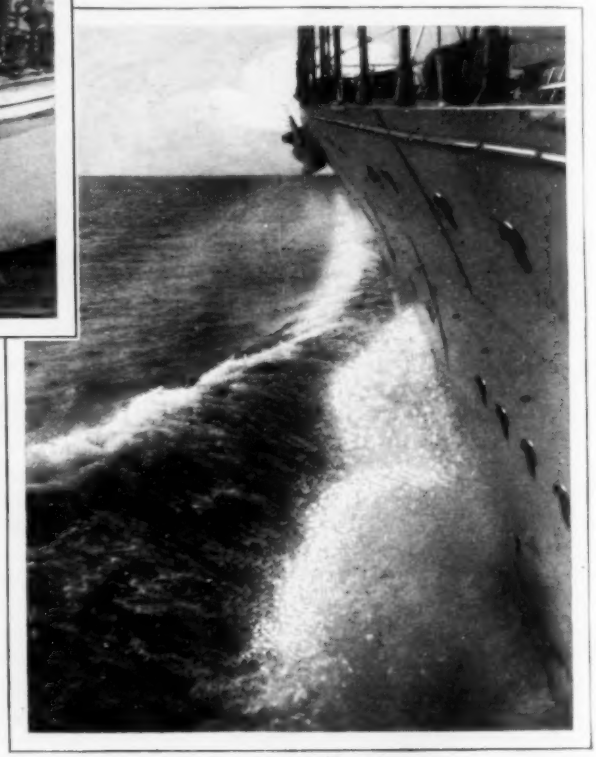
Dr. J. Paul Visscher, of the Western Reserve University, at the request of the government, has devoted three years to the study of barnacles. Much of his research has been carried on at Loggerhead key, the most southerly of the Tortugas group. Wearing a bathing suit and a diver's helmet with a special airline, Doctor Visscher has worked at depths of twenty-five feet. Altogether he has surveyed and experimented with the various kinds of barnacles found on 250 ships of the U. S. navy and private owners from the far corners of the earth while they were in drydock. His collection of barnacles recovered from these vessels includes some specimens which are over 2,000,000 years old. The barnacles range in size from microscopic mites to giants, three inches long and two inches wide. From fifty to 100 tons of barnacles are removed during a single scraping from some vessels, while cases are on record of from 200 to 300 tons of barnacles being removed from the hulls of very large vessels.

Propeller Incrusted with Barnacles, and Dr. J. Paul Visscher, Barnacle Researcher for the Navy

Barnacles are among the oldest animals which science knows anything about. They are like starfish and sea urchins in that they thrive only in salt water. Some of them die after four to six hours' exposure to fresh water, while others survive for fifty hours. Ship captains for centuries have taken advantage of this fact by anchoring their boats at regular intervals in fresh water. They believed that the practice aided measurably in the destruction of the attached adult barnacles. Doctor Visscher, however, has found barnacle shells on the bottoms of salt-water ships after they have been anchored continuously for thirty-five months in fresh water. In three months, barnacles grow to be as large as pigeon eggs, and a con-



Doctor Visscher has demonstrated that barnacles in their youth are sensitive to light in the blue-green but not in the ultraviolet portion of the spectrum. Blue-green light stimulates them so that they are attracted by such somber colors as red, brown, dark yellow and black. These colors, particularly dark red iron-oxide paints, are used chiefly in painting the subsurface of ships' hulls. In his study of ship hulls, Doctor Visscher also found that barnacles were most numerous in the shaded areas where bright light did not penetrate. This suggested employing light-colored paints for use on the hulls of ships. Unfortunately light-colored paints are especially soluble in salt water. Furthermore, the dirty water in many harbors darkens light paint even after short exposures. Here is a problem for the paint industry to solve—the development of a light paint which will not dissolve readily in salt water and will not change color easily in dirty water.



Above, Type of Helmet and Special Airline Used in Barnacle Surveys; Below, a Ship Freshly Cleaned of Barnacles

trol measure much more drastic than exposure to fresh water is necessary to loosen the binder which causes their adherence and to remove these shells.

Poisoning the paint used on the ship hull has been recommended as a preventive of fouling. According to Doctor Visscher, it is unsatisfactory, because, in order to make the poison effective, it would be necessary to apply ten times as much paint as possibly can be used. The official records of the patent office are rich in anti-fouling materials, such as mixtures containing quicksilver, gutta-percha, asphalt, plumbago, shellac, clay, fat, sawdust, hair glue, oil, soot, emery, castor oil, grease from boiled bones, unsalted butter and paris green, which have never worked for any length of time in practice. Even the government has developed a special anti-fouling paint which contains mineral spirits, pine oil, coal tar, rosin, zinc oxide, mercuric oxide, iron oxide, copper oxide and silicates.

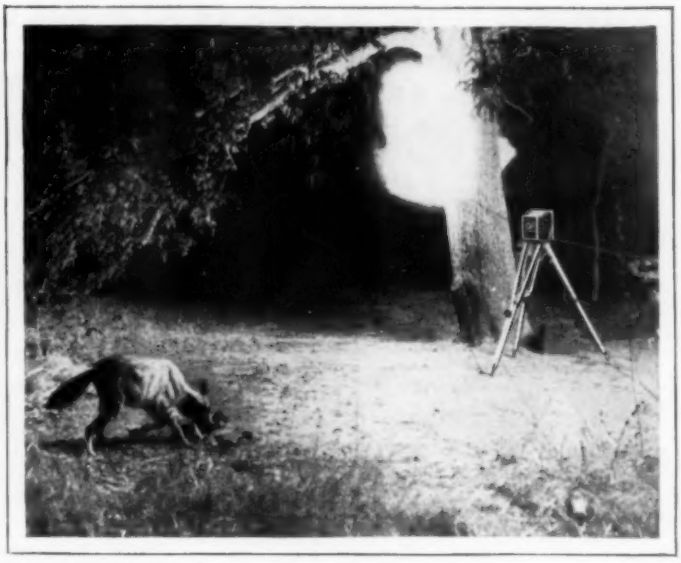
Future research may evolve practical

methods of electrocuting the barnacles by methods now undreamed of. This is a field of experimentation which has thus far been neglected as a possible source of a practical and relatively inexpensive system of divorcing barnacles from their favorite anchorage.

HAND-POWER RAIL CAR GIVES THRILL TO CHILDREN

Features of a real railroad enter into the design and operation of a hand-propelled car for children. It runs on a track of steel rails and oak ties, the drivewheels have siderods like a large locomotive, and the two four-wheeled trucks are designed like those that appear on regulation railroad equipment. The propelling mechanism consists simply of a chain-and-sprocket drive leading from the front axle to a head fitted with two crank handles, on top of the car. The child drives from a sitting position and can crank the three-foot car along the track with considerable speed and with perfect safety. The wheels are flanged, rails and ties are substantial and, if properly laid, will convert a backyard, a lane or any vacant lot into a playground for the child. The car can be driven in either direction and may be used to haul other units, so the youngsters can play "real" railroad.

Cranking the Car along Its Track of Real Rails and Ties; the Trucks Are like Those of a Locomotive; the Car Runs Backward or Forward



© C. Court Treatt

This Jackal Took Its Own Flashlight Picture When It Tugged at a Lure Which Was Attached by a Cord to a Camera Near By

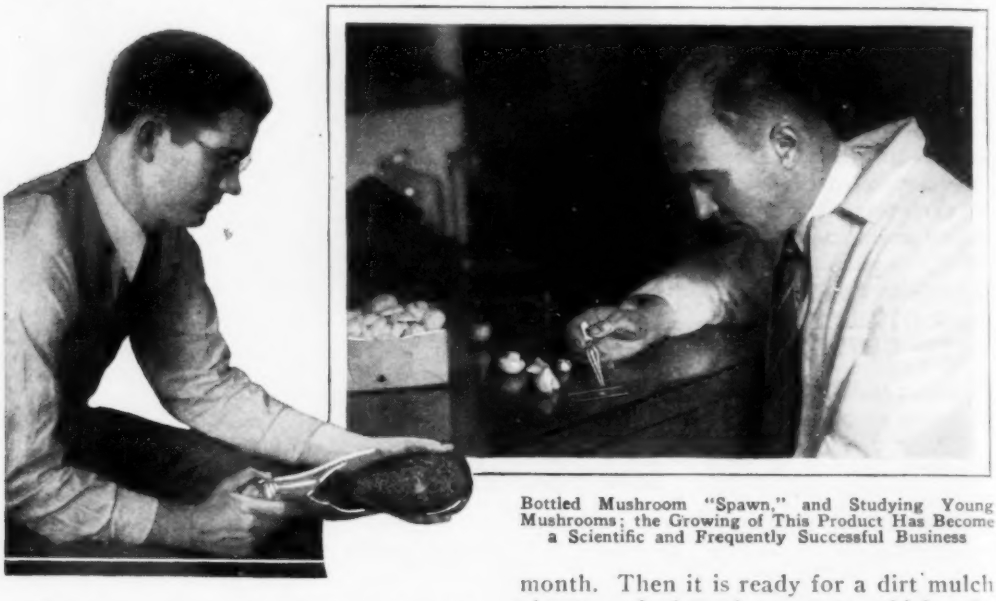
JACKAL TAKES OWN PICTURE BY SNAPPING FLASHLIGHT

Those who hunt wild animals with a camera in order to obtain pictures that are true to life, are often highly successful in inducing specimens to snap their own pictures by connecting a string from the camera to bait placed nearby. Maj. C. Court Treatt, veteran explorer of Egypt and the Sudan, obtained a picture of a jackal in this manner. Cameras were placed about the lure and connected to it, and the animal set off a flashlight when it tugged at the bait.

BOILER IS GIVEN LONGER LIFE BY WATER TREATMENT

Through a water-treatment process which has been tested for six years at the University of Illinois, the life of high-pressure steam boilers will be greatly prolonged, thereby saving millions of dollars to industries. The process has been found to prevent explosions from boiler embrittlement and has already resulted in a saving of $10,000,000 in the Chicago area alone. Because of alkaline waters high-pressure boilers have had to be replaced frequently, while a boiler normally should last from twenty to thirty years with this danger removed.

GROWING MUSHROOMS IS A MONEY-MAKING HOBBY



Bottled Mushroom "Spawn," and Studying Young Mushrooms; the Growing of This Product Has Become a Scientific and Frequently Successful Business

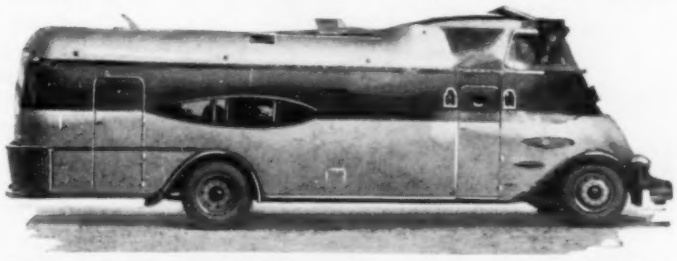
Mushrooms are now easily and safely grown, thanks to the scientific development of the industry. Today, fifteen to twenty millions of pounds of mushrooms are grown annually in the United States. In New York City alone it is not uncommon that twenty to thirty tons of mushrooms come on the market daily. And there are other great city markets for this delicious tidbit, notably Chicago, Philadelphia and Baltimore. What are the new developments which have advanced this lowly fungus to an exceedingly profitable commercial product? Chiefly the control of the method of making spawn—the threadlike growth of mushrooms underground—which insures them against diseases and pests. Now, cultivators of mushroom spawn distribute and sell it directly to growers. In old days they used to gather it wild and sell inoculated growing material compressed into small bricks. But this was crude and dangerous. The new method gives the mushroom grower a pure product called "bottle spawn." Houses are now built especially for mushroom culture. The beds are in tiers one above the other at intervals of about two feet. After the beds have cooled to ordinary temperature, the spawn is placed in them, a piece every eight or ten inches, and allowed to grow for a month. Then it is ready for a dirt mulch about an inch and a quarter thick. In two or three weeks mushrooms begin to appear and keep coming for five or six months. At the end of this period, the growing is over, and it becomes necessary to throw out the beds, disinfect the house and start all over again.

POWER SCYTHE RUN BY MOTOR OPERATED BY ONE MAN

Operated by a one-half horsepower motor, a power scythe for mowing roadside grass and weeds, and for airports, golf courses and large grounds generally, can be operated easily by one man. The scythe is attached to a one-wheeled frame with handles like a plow, the operator pushing the implement while the motor operates the cutter blade. A starter operates the motor with the pull of a handle, and vibration has been reduced by a frame of cantilever construction and by having the handlebars trunnioned at the axle of the wheel.

TALKIE THEATER ON WHEELS TO TOUR HIGHWAYS

Roadside audiences on the Pacific coast are being entertained by a talking-picture theater on wheels which brings the movies to the patrons. This traveling theater, costing $50,000, is contained in a giant truck, weighing 20,000 pounds and provided not only with projection room and sound system, but also equipped with running hot and cold water, tiled shower bath, kitchen and living-room facilities and sleeping accommodations for six persons. It is being used by a theater organization to advertise its films. This huge land cruiser is thirty-four feet long, eight feet wide, twelve and one-half feet high, and is driven by a 160-horsepower motor. A pilot house is located above the engine room at the front of the vehicle and is reached by a stairway. The projection room is lined with metal and equipped with an automatic sprinkler system for use in case of fire. The generating system includes one 2,500-watt direct-current automatic gas-engine-driven plant, and a one-kilowatt alternating-current electrically driven plant. The kitchen is equipped with an electric range, and there is an automatic electric water heater, an air-compressor system to provide pressure for the water plant, and electric refrigeration is a feature, while built-in furniture saves space in the living room. When two large doors at the rear are opened, the screen is exposed, and pictures are projected to and through it from the projection room at the front, being viewed by an audience standing outside the vehicle at the rear. Sound reproducers are located just under the screen. The projection room is fitted with the most modern equipment and resembles that found in the up-to-date moving-picture theater.



Giant Truck Containing a Complete Talking-Picture Projection Apparatus; the Vehicle Has Living Accommodations for Six Persons

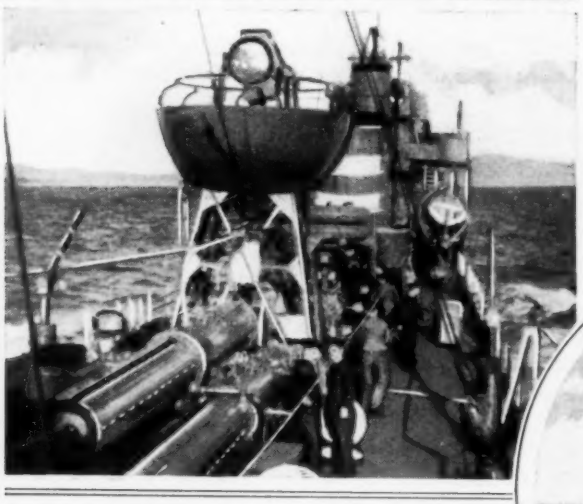
FURNITURE FROM OLD PAPERS USED IN SUMMER HOME

Novel furniture for a summer cottage in Massachusetts has been fashioned from old newspapers, tightly rolled into small "sticks" and fastened together. The outer surface was treated to make it waterproof. Chairs, tables, floor lamps and other articles have been made from the paper rolls.

Floor Lamp, Table and Chairs Fashioned of Rolled and Pressed Newspapers

OYSTER LARVÆ NEED COPPER BEFORE SETTLING DOWN

Young oysters will not forsake a roving life and settle down as substantial citizens until they have had a dose of copper. This has been discovered by government investigators who are trying to make oysters more abundant. When an oyster first hatches from the egg, it lives for two weeks as a free-swimming larva. If it lacks copper, it is victimized by microscopic organisms. If it gets its copper, it sinks to the bottom, protrudes its one foot on which it crawls about for a time, then exudes a gluelike substance, plants its shell squarely in this, and is fixed for life.



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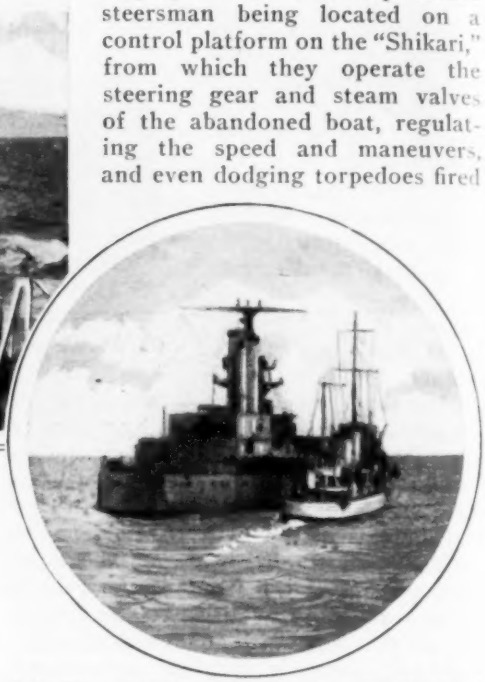
BATTLESHIP STEERED BY RADIO IS TARGET FOR GUNS

Steered and controlled entirely by radio, a 20,000-ton derelict battleship is a fascinating target for Great Britain's Atlantic fleet. This boat, which returns to the dockyard for repairs after every "engagement," is the "Centurion," and it is shelled and bombed regularly by battleships, cruisers, destroyers and airplanes. It carries a crew of 250 who desert the ship just before it goes into battle. The crew takes the vessel to the war area, strips the wheelhouse of its fittings, removes the contents of the deck cabins, and, leaving the engines throbbing, quits the big boat for the little destroyer "Shikari." From a distance of about a mile astern, the destroyer steers the deserted warship by radio, the radio pilot and steersman being located on a control platform on the "Shikari," from which they operate the steering gear and steam valves of the abandoned boat, regulating the speed and maneuvers, and even dodging torpedoes fired



Left, View of Destroyer Which Steers the Abandoned Target Battleship by Radio; in Circle, Target Ship and Her Destroyer Companion

by attacking vessels. The old boat is pommeled and battered by high explosives until the attackers decide she has had enough, then the crew again boards it and takes it to port for repairs. It carries no guns and no turrets and the engines are about the only vital parts that have not suffered damage at some time or another.

CELLULOSE SPRAYED ON EARTH TO ERADICATE WEEDS

Eradicating weeds from a field under cultivation by smothering them is the method proposed by a German engineer who has made a cellulose sprayer for this purpose. By spraying a field with one part of cellulose diluted in ten parts of water, a continuous tough skin, adhering to the ground, is produced. This will not dissolve or wash away but can be peeled off easily after harvest. The method is inexpensive, and tests have shown that it chokes weeds with weak germinating power, and so saves weeding and ridging. At the same time, it insures a richer and better crop, because the nutriment in the ground is available solely for useful plants, and also because moisture and heat absorbed by the earth are prevented from evaporating or escaping. The idea of covering weeds with paper to destroy them first was tried in Honolulu, where tough wood paper was laid by machines operated by tractors or horses. This process, however, is both expensive and often impractical while the spraying method is applicable to all useful plants except cereals.

SPEED OF LIGHT IS UNCHANGING ACCORDING TO TESTS

Light travels always at the same speed, according to the finding of a scientist who thus adds fresh proof of the correctness of Professor Einstein's relativity theory in which it is assumed that the velocity of light is absolute. Prof. Georg Joos, of Jena University, Germany, claims to have proved the uniformity in the speed of light by the use of a device which he says measures accurately one-thousandth of the length of a light ray. A wavelength of light varies from about one twenty-five-thousandth of an inch for red to about half as much for violet, and Professor Joos claims to detect fractions of wavelengths ranging from one twenty-five-millionth to about one fifty-millionth of an inch. He obtained the added accuracy partly by the use of quartz in his instrument, the light rays coming from a mercury quartz lamp, and being measured with the aid of a camera. The instrument is so sensitive that a sound such as a hand clap registers as a visible dent in the curve the camera produces.

MIDGET-SIZE PUSHER PLANE STEERED BY WING FLAPS

Weighing less than 400 pounds and powered by a twenty-five-horse engine, a two-place monoplane attracted attention at an aircraft show in Omaha, Nebr. It is of the pusher type, that is, the propeller is behind instead of in front of the wing, and the usual rudder is replaced by flaps in the "trailing wings," surfaces at the rear of the main wing. In addition to serving as a rudder, these flaps, which work independently, can be used to decrease the speed of the plane, it is said.

One of the Midget Planes That Promise Wide Favor This Year; the Engine behind the Wing Affords Added Visibility

Electric Loader Which Handles Bulk Material; It Is Used to Empty Freight Cars Quickly

FREIGHT CAR EMPTIED QUICKLY BY ELECTRIC LOADER

Bulk materials, such as grain, cement, sand, slack coal and gravel, are speedily removed from box cars by an electric loader which handles lumps not exceeding four inches at the rate of one-half cubic yard a minute, dumping the material directly into wheelbarrows or hopper conveyors. The machine is mounted on two roller-bearing wheels with a smaller wheel for steering, and is run by a five-horsepower motor. A pawl-and-ratchet mechanism crowds the machine into the material, and the feeding drive can be backed out by reversing the pawl. Five speeds are available in either direction. One man can easily move the equipment by disengaging the drive and tilting the boom back on the chassis, the boom support being almost at the center of gravity. The material is fed into buckets on the loader by means of a spiral ribbon-type feeder. For dusty material, a canvas chute is hung from the discharge end, and the bucket line is housed.

With the Movie

Staging a Circus Parade for the Movies; the Buildings Have False Fronts but Everything Else Is Real

By ANDREW R. BOONE

TEN years ago a wandering circus owner "played the sticks" across the continent and eventually landed in Hollywood. As his train of automobiles passed the studios, he decided a permanent location with performances for the screen offered more comfort than one-day stands and uncertain seasons.

Since then Al Copeland has made forty-one circus pictures; has put on fifty carnivals for motion pictures, and has supplied equipment, actors, acrobats, freaks, fleas, ants and elephants for innumerable bazars, county fairs, medicine shows, picnics, traveling museums and European fairs—all for the screen.

In less than a day and night, he will gather his canvas and props, bring in the animals from his ranch, assemble the performers and have his five-ring circus ready for the cameras to shoot the scene. When Copeland puts on his circus for a picture, unless the story requires a different arrangement, he runs through the entire show. Veteran troupers—clowns and trapeze artists—put on their acts just as though they were appearing before a paying audience. As a result, whenever a circus picture is being shot, crowds storm studio gates. Recently 10,000 people crowded into the tent one morning to see the performance, and another throng came in the afternoon for the second performance. They saw the show and the movie stars free, and the studio saved $50,000 by not paying the regular wage for extras.

Every time you see circuses, or hot-air balloons and parachutes, or exciting circus-fire scenes, or well-trained animals in that type of picture, you know Copeland

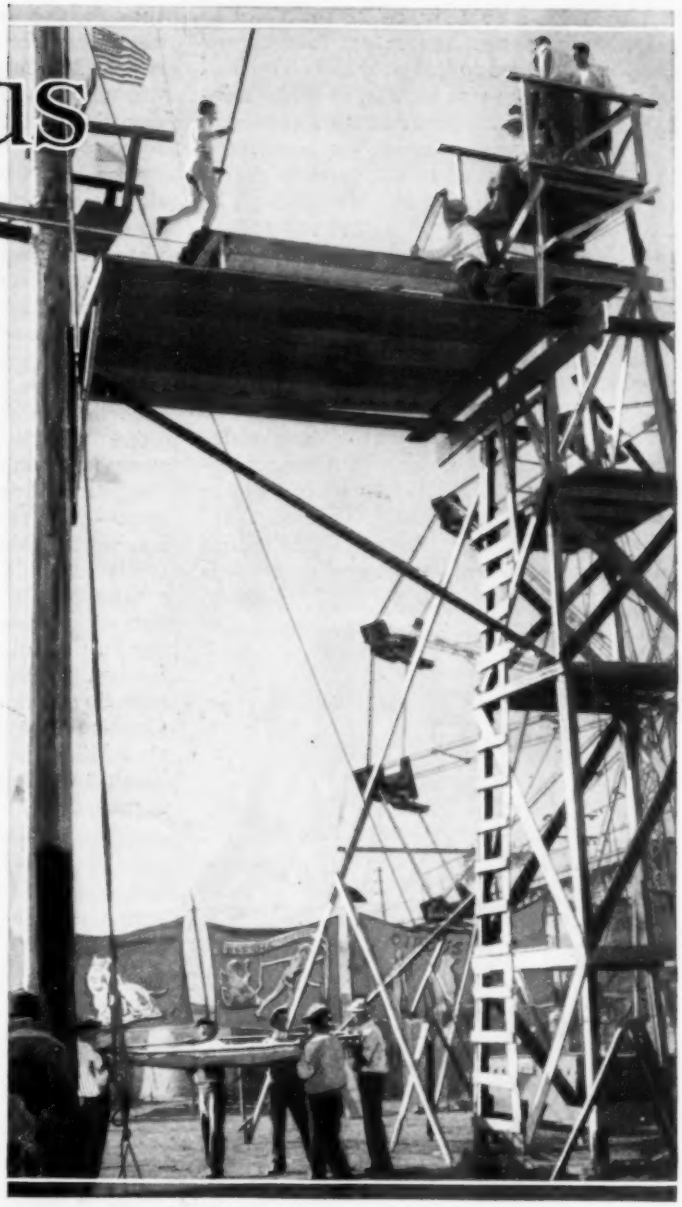
Circus

has a good deal to do with it. He's the only one of his kind in the movies, and he has at his tongue's tip the names of 800 circus performers living in and near Hollywood. He can produce in a half day forty expert trainers who will undertake to train anything from a flea to an elephant, a minnow to a whale, to act acceptably before any audience. "I have never failed yet to fill an order," he says. "When the talkies arrived we trained the animals almost overnight to respond to pantomime instructions. Today we can provide anything that lives for any kind of a show. Recently a studio called for 1,000,000 red ants for a comedy scene. Our men went into the hills with a half barrel of sugar and several nets. By scattering trails of sugar to the nets, they soon gathered in the ants.

"Another studio wanted bats. Our men got them from underground mines. We get hurry orders for queer people, the tallest or the fattest."

Twice recently, a director suddenly called for five fish and a fire. Copeland produced the live fish in two hours and later burned his own circus to the ground to satisfy the director!

A rehearsal preceded the fire. All the paraphernalia, except the poles and some old seats, were removed. Then several smoke candles were lighted to determine how the animals would react. Zebras, horses, elephants and camels stampeded. One camel dived head-long into the rear of a sound truck where the "mixer" was adjusting his apparatus to record the stampede. The horses fled to one corner of the lot, the zebras herded in another, but the camels galloped singly in all directions. Thirty-five cowboys rounded them up and brought them back for the real conflagration.



Filming a High Wire-Walking Scene; the Platform and Life Net Were Rigged to Catch the Performer in Case of a Fall

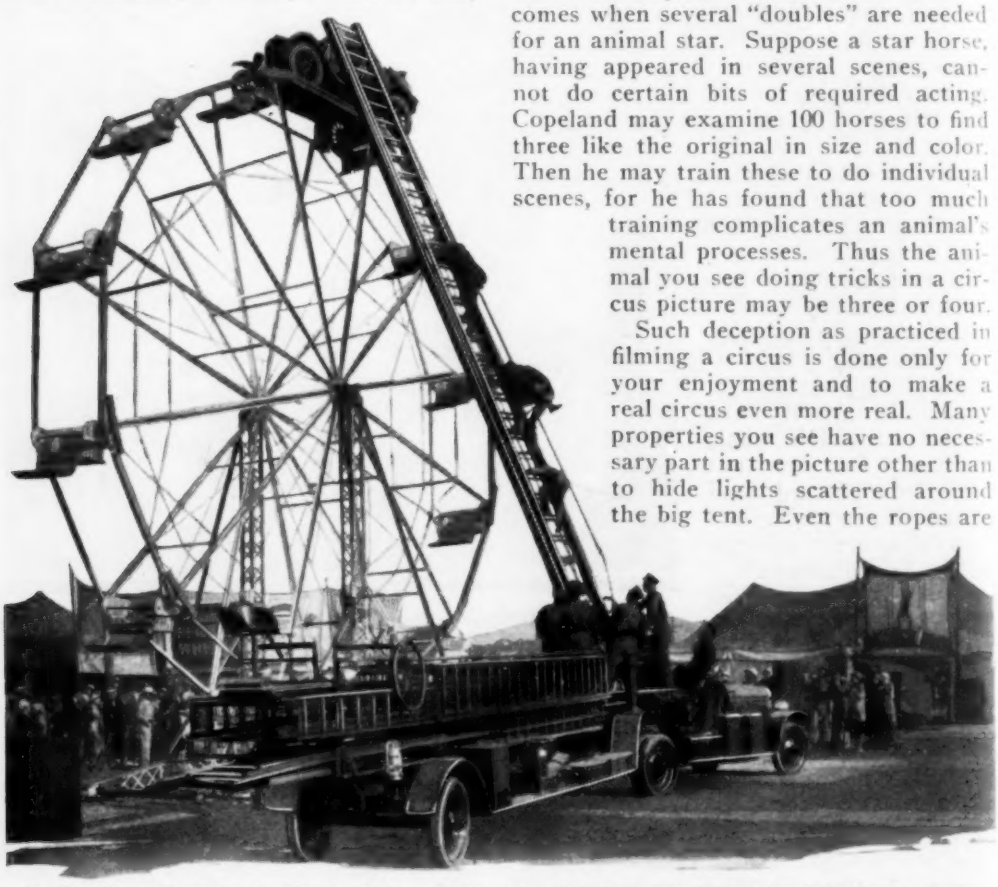
The story, a comedy, called for a riot to start among the spectators and show people. One group inadvertently knocked over a pop-corn wagon, and in a few minutes the tiny blaze had run up a side wall and spread over the entire "big top." Soon the tent had burned to the ground. Fires of this sort require careful timing. The gasoline-soaked side walls and top spread the blaze very fast. Before the action commences, the unpaid audience departs, and only a handful of paid extras remain inside to rush past the camera as the flames spread. Animals are herded near the exit with cowboys and attendants at hand to drive them out safely.

In filming such a picture many miles of cables bring the noises from ten microphones to the mixing booth where all are blended for the celluloid. Voices of actors record well, under canvas, although they are pitched higher than when recorded on a soundproof stage. Sometimes, though, the animal sounds you hear in a circus picture do not come from the animals. Movie technicians improve on nature and make synthetic growls and squeals better than the animals themselves.

The story is told of one monitor man, new to a circus picture, who was instructed to record a giraffe's laugh. The microphone on its sliding boom would not quite reach the giraffe's head, so the monitor man hung special ropes to extend the "mike" higher into the air. Meantime he inquired of actors, circus men and assistants just how a giraffe's sounds should be recorded. They "cued" him and he practiced a half day, emitting sounds he thought should come to his ears. At last the microphone was hung properly and then—only then—did he learn a giraffe, having no vocal cords, can emit no controlled sounds.

One of Copeland's most difficult tasks comes when several "doubles" are needed for an animal star. Suppose a star horse, having appeared in several scenes, cannot do certain bits of required acting. Copeland may examine 100 horses to find three like the original in size and color. Then he may train these to do individual scenes, for he has found that too much training complicates an animal's mental processes. Thus the animal you see doing tricks in a circus picture may be three or four.

Such deception as practiced in filming a circus is done only for your enjoyment and to make a real circus even more real. Many properties you see have no necessary part in the picture other than to hide lights scattered around the big tent. Even the ropes are



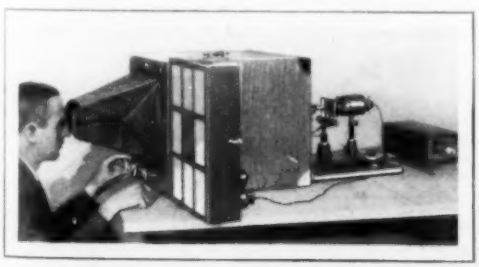
In One Circus Stunt for the Movies, an Automobile with a Substitute Wooden Engine, Was Carried to the Top of a Ferris Wheel

painted a light gray, to photograph white, and all poles and boxes are tinted and aged with burned umber to kill the glare. Seats are moved out four to six feet from the side walls to make room for batteries of lights.

Recently one studio called in the morning for a circus. Twelve hours later two of the twenty-six acres comprising the studio lot were under canvas. A score of gaily painted wagons paraded onto the lot. Five tons of sawdust appeared as if by magic and was scattered about the "big top," the menagerie tents, pad tents and side-show booths. Peanuts and popcorn, elephants and a steam calliope were on hand. Most important of all, 200 trained performers had reported in costume ready for work.

SIMPLE WOOL GAUGE TESTS SIZE OF FIBERS

To determine the thickness of wool and other fibers in certain tests, a gauge introduced in Germany is said to be so simple that it requires no professional skill or knowledge to operate. The instrument either compares the fiber under investigation with standard fibers, or makes an actual measurement of the sample itself. In the former test, an enlargement of the fiber is thrown upon a screen, where it is quickly compared with several standard measurements displayed in a similar manner. When an actual measurement is to



Measuring Fabric Fibers in Special Gauge Which Compares Their Size with Known Standards

be made, the fiber is still further enlarged and quickly gauged according to an accurate scale. As many as 100 fiber tests can be made in ten minutes after short practice, it is said, and photographs of the fiber's rating can be taken from the machine. Current to operate the projector is obtained from a lighting socket.

Sailors at Work Painting One of the Giant Anchors of the British Battleship "Nelson"

GIANT ANCHOR OF BATTLESHIP GIVEN SPRING CLEANING

Some idea of the huge dimensions of the H.M.S. "Nelson," one of Great Britain's finest and largest battleships, was offered when a photograph was obtained of sailors at work painting one of the giant anchors. This ship and others of the Atlantic fleet were given a thorough cleaning from anchors to gun turrets before the vessels started on the first leg of a voyage to the Panama Canal zone.

TRAFFIC LIGHTS SUNK IN ROAD ARE EASILY SEEN

Some English cities are taking their traffic lights from posts beside street intersections and sinking them in a line across the roadway, flush with the surface. When traffic is to be stopped these lights make a vivid red line across the highway. Those adopting this system claim the sunken lights are more easily seen by motorists, who naturally have their eyes on the road ahead. It also is claimed the line of red lights exerts a psychological effect on drivers who are less likely to drive across a red line than to disregard a red light beside the road.

Recruits at Detroit's Training School for Firemen Learning to Carry Victims down Ladders

TRAINING SCHOOL FOR FIREMEN IN SEVEN-STORY TOWER

One of the finest training schools for firemen in the world recently was built in Detroit at a cost of $250,000, the structure being a seven-story tower containing every appliance known to the fire-fighting profession. Indoor and outdoor drills are provided for, the interior being built to represent a factory or building wall, complete with fire escapes and windows of every type found in such structures. It is high enough to operate a seventy-five-foot aerial ladder. Among other features are classrooms where recruits are instructed in artificial respiration, knot-tying and other drills.

DEAF MAN "TALKS" AND "HEARS" OVER TELEVISION WIRES

Using the finger alphabet, a deaf man in New York recently carried on a conversation with his son over a two-way television system, thus being able to "talk" and "hear" over the telephone for the first time. The son, whose hearing is normal, conversed with his father in the sign language. The only case at all similar was that of a deaf girl who had communicated by lip movement over a like system. In the latest test, the participants had the added trouble of trying to distinguish between the face of the "talker" and the fingers superimposed on the same plane, but the eyes soon became accustomed to this. One advantage of the system, which may open up a new vista in the life of the deaf, is its elimination of the use of telephone instruments which so obstruct the view as to impede such a form of communication. This is accomplished by using a microphone sensitive to remote sounds and a loud speaker concealed near the television image at each station.

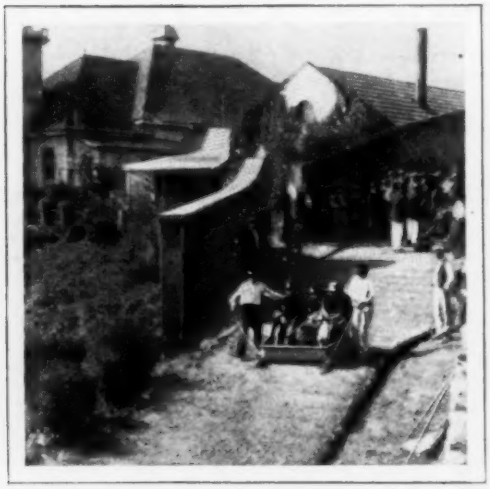
ENGINE STARTER FOR PLANES PLUGS IN LIGHT CIRCUIT

To speed up the cranking of airplane engines not equipped with automatic starters, an electric starter, known as an external energizer, now is being employed. It is plugged into an electric outlet on the field and is slipped over the crank fitting of the hand starter. If electric lines are not available, the starter can be operated by a 110-volt direct-current generator driven by a gas engine mounted on a truck. Only one man is required to use the energizer.

Electrically Operated External Airplane Starter Which Fits over Crank of Hand Starter

LIFE LINES RELIEVE THE CREW OF OCEAN BEACON

Above, Relief Boat with Lines Attached to Bishop's Rock Lighthouse, off Scilly Islands, England, Where Tides Are So Dangerous Vessels Cannot Tie Up at the Rock; at Right, Above, Relief Entering Main Doorway of Lighthouse, and, Below, One of the Keepers Sliding Down to the Relief Boat on Ropes; Note Swirling Waters at the Foot



Natives in Madeira Grease the Runners of This Sled as It Slides down a Mountain Side

SLEDGE ON GREASED RUNNERS SLIDES DOWN MOUNTAIN

Visitors to Madeira always go to the top of the mountain which dominates Funchal, the principal town. Once at the top, they have no worry about descending the 3,000-foot elevation as they slide down in huge basket-work sledges. These sledges are controlled by two natives who grease the runners as the strange conveyance proceeds down the smooth path laid for it.

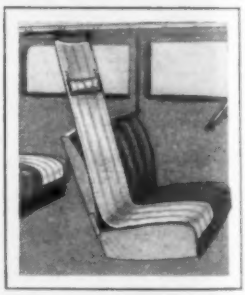
GOGGLES FITTED WITH LIGHTS FOR USE IN THE DARK

Goggles provided with electric lights and reflectors instead of lenses are useful in performing tasks in the dark, since the wearer has both hands free for work, the light being concentrated in whatever direction the head and eyes are turned. Reflectors are mounted in the frames and small electric lights are set at the top of the reflectors, with protective disks around them. In the center of the reflectors are circular sight holes with screens, which keep the direct light from the lamps out of the eyes. The goggles are connected by a length of cord containing a switch to a small battery that can be carried in a vest pocket, or a connection can be made by plugging into a socket.

CAPACITY OF ARC RECTIFIERS IS EASILY INCREASED

By using a large number of small anodes, or their equivalent, and narrow arc paths, engineers of the General Electric company have devised a way to increase the current-carrying capacity of mercury-arc rectifiers employed in changing alternating current to direct current. This is accomplished practically by combining the small anodes into a single large one and subdividing the area below it into a multiplicity of small, parallel arc paths. The maximum current-carrying capacity today is represented by the twenty-four-anode 10,000-ampere 625-volt General Electric rectifier for an electrolytic plant. A twelve-anode rectifier now being built at Schenectady for railroad service will handle 14,400 amperes at 625 volts.

HAMMOCKS FOR AUTO SEATS GIVE REST FOR HEAD



To afford a comfortable rest for the head when automobile driving, and to shield the occupants of the car from drafts, an adjustable hammock arrangement for the seats has been introduced. It is attached at one end to brackets screwed to the bows of the auto top and descends over the seat, providing a pillow, adjustable to different heights, for the head, and an efficient screen that cuts off drafts around the head and the back of the neck when one of the car windows is open. Springs eliminate the transmission of vibrations from the top of the car to the head. The hammocks are made of durable seat-cover material, are easily adjusted and, when not in use, can be taken down and folded away in a small space.

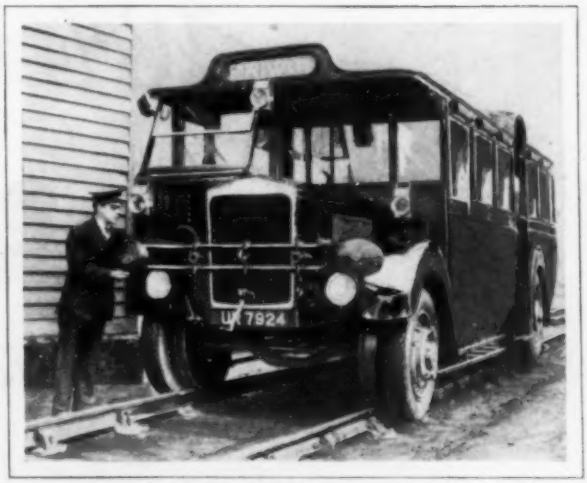
TO STOP MARINE BORERS BY EMBALMING TREE BEFORE CUTTING

To protect wood against marine borers, termites, fungi and other pests, entire trees are being embalmed with a poisonous compound before they are cut, under a method instituted by two members of the staff of the University of California. The bark of the tree is ringed three feet from the ground, holes being bored at intervals about the ring. The tree is encircled with two crescent-shaped pipes, and a solution of arsenic and copper compound runs by gravity from a tank to the tree and there is distributed by the sap to every cell of the plant. The solvent holding the poison soon evaporates, thus leaving the compound to become a part of the wood tissue in which it is deposited. Large trees can be embalmed by the method in from twenty-four to seventy-two hours.

PADDLE FLOAT FOR SWIMMER GIVES HELPFUL EXERCISE

Devised especially to develop the swimmer's leg movements, a paddle-propelled float has proved popular at bathing beaches. The rider lies in a natural swimming position with the legs free to practice various strokes, and is kept afloat by the buoyant body of the slender raft. The hand-propelled paddles provide forward movement and since the arms are also moved as in swimming, the rider enjoys helpful practice and exercise while mastering various strokes.

Using the Paddle Float for Swimming Exercise; the Rider Takes Essentially the Same Position as in Swimming Unaided



Motor Bus with Flanged Wheels, Set beside Road Wheels, That Enable It to Travel on Railroad Tracks or Highways

MOTOR BUS FOR RAILS OR ROAD HAS FLANGED WHEELS

Capable of traveling on railroad tracks or on paved highways, a motor coach with flanged wheels set beside road wheels recently was placed in use in England. The flanged wheels are fitted to the axles, and on the outside of these are placed pneumatic-tired road wheels which are mounted on eccentrics. The bus can be operated independently on rails or attached to a train. Change from one method of travel to the other requires less than three minutes.

RIVER TENDERS FOR AIR LINERS

To establish rapid communication with the shore for passengers and mails when the flying boats of the English-African airways alight at various points along the river Nile, the Imperial Airways has provided river tenders in the form of power boats, luxuriously equipped and capable of a speed of twenty-five miles per hour. As soon as the air liners touch the water, the power boats draw alongside, and the transfer of passengers and mail is completed in a matter of minutes.

With the Black

Photos Courtesy EMELKA

Sketch of Arab Troop on March and Slave-Raider Crossing African Desert

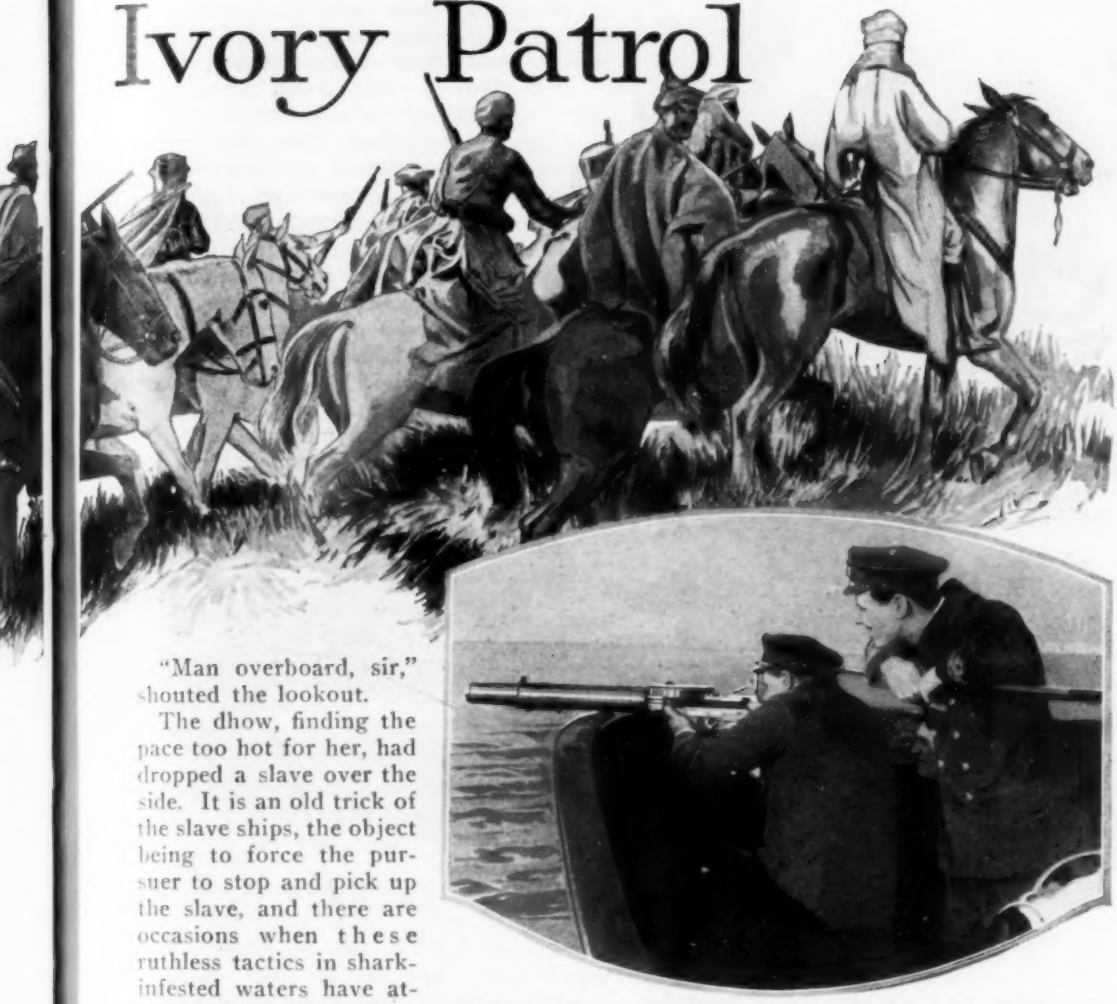
By HAROLD T. WILKINS

ONE dark, moonless night at the southern entrance to the Red Sea, a British gunboat was lying under the lee of a notorious island—a halfway point between Obok, the "black ivory" rendezvous on the African mainland, and Mocha, the capital of an Arabian potentate on the other side of the Red Sea. Midnight approaching, the lookout sighted a craft, with a lateen rig, stealing out from the craggy shores of what is known as "Slave Island." The strange ship was freighted with a cargo of black ivory, or slaves from Abyssinia.

With the wind behind her, the dhow was rapidly vanishing, when suddenly, the huge sail stood out clearly against a powerful searchlight trained on it from the deck of the gunboat. Before the craft could maneuver once more into the shadows, the warship fired a round from her four-inch gun. The shot whistled over the mast of the dhow and splashed into the sea.

The Arab skipper ignored the signal to stop and be overhauled, and attempted to tack off the course into the darkness, with the gunboat in hot pursuit. Slowly the gunboat began overhauling the swift dhow, when—

Ivory Patrol



British Anti-Slavery Patrol Sloop on Duty in Red Sea with a Machine Gun Trained on an Arab Slave Dhow

"Man overboard, sir," shouted the lookout.

The dhow, finding the pace too hot for her, had dropped a slave over the side. It is an old trick of the slave ships, the object being to force the pursuer to stop and pick up the slave, and there are occasions when these ruthless tactics in shark-infested waters have attained their object. But, in this case, the move was foreseen and checkmated. The slave, a strong swimmer, got astride the life buoy that was thrown to him from the gunboat and thrashed the sea vigorously with his feet to scare the sharks.

Soon the warship is abreast of the dhow which is packed with armed Arabs, dressed in white robes and turbans. Confronted by two four-inch guns and a battery of machine guns ready to fire at almost point-blank range, the slaver decides to let the British patrol come aboard, and the black cargo is diverted from the open slave markets of Mocha and the Hedjaz.

It is estimated that 500 slaves each year are secretly shipped across the Red Sea from Somaliland and Abyssinia, but owing to the vigilant patrol of the British naval sloops "Clematis," "Dahlia," "Lupin," and the new oil burner "Folkestone," slavers are finding it yearly harder to elude the sloops and land their cargo.

Max Gruhl, a former German officer, who has spent twenty-four years in the wilder regions of Abyssinia and, disguised as an Arab, has watched the Arab dhows ship their cargoes across the Gulf of Perim to Arabia, says there are hiding places in the dangerous regions of savage Somaliland, where no European consul dares go, and where Arab slavers pen kidnapped blacks behind bomas, or thick thorn-hedge stockades.

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Wealthy Abyssinian Chief Starting to the Hunt with His Slaves, and, Below, Typical Patrol Sloop on Duty

"All naval officers know of the slave dealing," recently said Comm. Hugh Woodward, R. N., retired, late of the sloop "Clematis" on patrol in the Red Sea, "but not one man in a hundred would believe the appalling facts. In five recent years, 5,000 slaves—men, women and children—have been shipped across the Red Sea to Arabia, for sale in the open markets. Powerful Abyssinian chiefs derive much profit from the traffic. They raid for slaves with armed forces and ship them in Arabian dhows which land them across the Red Sea. Here, the slaves are split up into twenties and thirties, and put into smaller craft which keep inside the rocky shoals and reefs at night."

The commander adds that the slave trader has his spies and agents all over the hinterland of the Sudan in Africa, in Arabia, and in the wild regions back of Italian Eritrea and French Somaliland. "His armed columns swoop down at night on a village and the entire salable population, men, women and children, is carried off in chains. For days, they are marched toward the coast, through Abyssinia and French Somaliland, right into the streets of Tajoura and Obok, and there shipped in dhows and carried across the straits of Perim to South Arabia."

Ras Tafari, the "conquering Lion of Judah," who was recently crowned emperor of Abyssinia, has declared against the slave traffic and tried to free the two million slaves in Abyssinia, but the powerful vassal chiefs, some of whom have retinues and households of 1,500 slaves each, refuse to heed him. Slaves, it is stated, can be bought in thousands at certain inland markets in Abyssinian wilds. These markets are stocked by Arab raiders and by Abyssinian chiefs, who raid for slaves when taxes remain unpaid. Smaller sheiks hand over black ivory to the greater, in lieu of tribute.

Watching the southern borders of Abyssinia, are the King's African Rifles, in Kenya colony, where slave raids are frequent. One dark night, a few months ago, these British-African troops encountered a large force of well-armed Arabs, who had stolen across the frontier to raid the negro villages and kraals of Galla. When the troops met them, the Arabs were returning with a black cargo. A sharp fight followed. The slavers were armed with 400 rifles. Three of them were killed and ten wounded. Then the King's African Rifles got on the trail of slavers who had rounded up hundreds of men and women from native villages near the Loburin river on the Kenya frontier. They chased

the raiders for many miles, and overtook them. Seven of the Arabs were shot, and the captive negroes and many hundreds of stolen cattle recovered.

Lord Cecil has estimated that there are at least 5,000,000 human slaves today. A tale of murder, torture and oppression was recently unfolded in the report of an international commission of inquiry into slavery in Liberia.

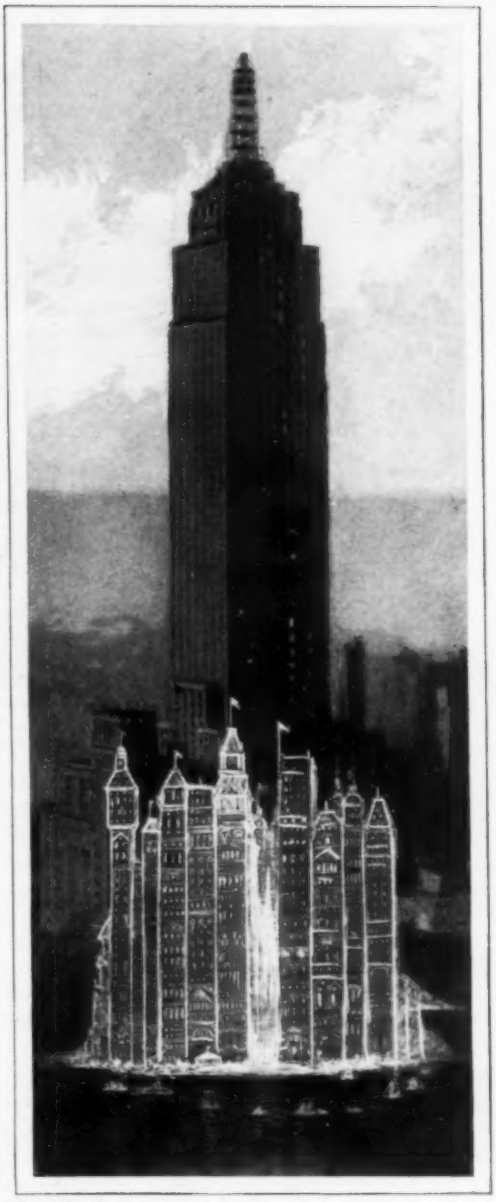
Among the slavelands today are listed Abyssinia, Afghanistan, Arabia, Sierra Leone and Liberia, while modified slavery is said to be found in Portuguese East Africa, Portugal's West African colonies, St. Thomas and Principe, French Equatorial Africa, and Tanganyika territory.

BETTER LIGHTS FOR HOME TO USE LESS POWER

Better light on half the power required for incandescent-filament bulbs is promised from glowing tubes filled with rare gases, a refinement of the tubing system now widely employed in advertising signs and similar displays. The new lighting, suited to home and office illumination, will operate on either 110 or 220 volts, instead of requiring such excessively high voltages as are now necessary in neon tubes. It will give much less heat than is generated from incandescent lighting and produces the most efficient light for reading without eye strain. The development is the result of four years of laboratory research in which one of the main problems was to obtain the proper mixture of helium, neon, argon, krypton and xenon, rare gases of the atmosphere, to produce the desired results.

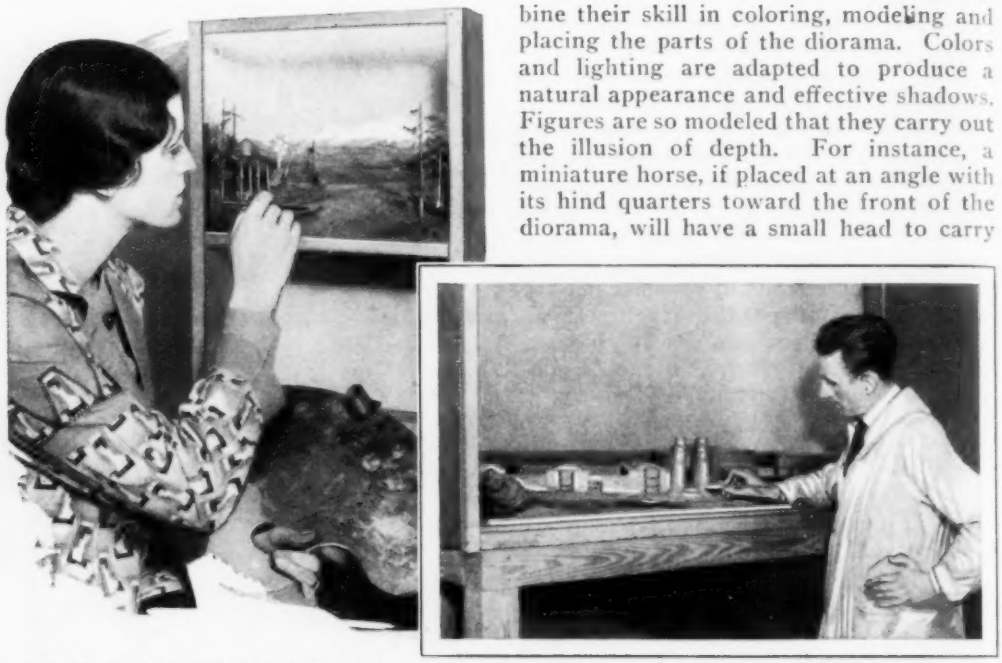
SKYSCRAPER DREAM OF ARTIST EXCEEDED BY REALITIES

Fifty years ago Thomas Nast, a cartoonist, made a pen-and-ink drawing of the New York of the future as he foresaw it. Skyscrapers were then just beginning to catch the American fancy, and he let his imagination run riot, producing a group of buildings, one of them almost thirty stories high. The sketch, termed a "dizzy dream" in 1881, has been exceeded three times over by present-day realities, as proved by superimposing the drawing on an actual photograph of the Empire State building, taken from another structure half a mile distant. The modern skyscraper lifts its eighty-five layers of offices 1,050 feet above the sidewalk and the top of the dirigible mooring mast is 1,250 feet above street level. In all, the shaft reaches the equivalent of 102 stories.



Drawing Made Fifty Years Ago of an Artist's Conception of the New York of the Future Superimposed on Photograph of Empire State Building

MAGIC OF DIORAMA TO REVEAL WONDERS OF FAIR



Finishing Model Sketch from Which the Diorama Will Be Prepared, and Partly Completed Diorama in Cabinet; the Figures Represent Buildings Proposed for the Century of Progress World's Fair

Realistic displays, representing machines, industrial plants and scenes from many phases of life in true colors and proportions are being constructed for the coming Chicago Centennial world's fair. These exhibits, known as dioramas, "shrink" into the space of but a few square feet in area that occupies several square miles in real life, but the arrangement of the figures, scenery and all details is so carefully done that the illusion is accurate, and the effect on the eye is practically the same as that of the actual scene. To do this, artist, sculptor and architect combine their skill in coloring, modeling and placing the parts of the diorama. Colors and lighting are adapted to produce a natural appearance and effective shadows. Figures are so modeled that they carry out the illusion of depth. For instance, a miniature horse, if placed at an angle with its hind quarters toward the front of the diorama, will have a small head to carry out the impression of distance. Every detail of the set is arranged to blend into the general plan, and the result is so accurate that a photograph of the scene within the diorama is difficult to distinguish from a photograph of the actual scene on which the display is based. Edward J. Ashenden, of London, an expert in this form of art, has been brought to Chicago to supervise the construction of the dioramas, and a large studio, the only one of its kind in the world, has been equipped for the sole purpose of devising these magical displays.

BIRD "ACROBATS" RIVAL PLANES IN FLYING UPSIDE DOWN

Flying stunts are usually associated with planes and aviators, but naturalists report that some birds are also skilled in aerial acrobatics. Sydney Evershed, a British bird lover, tells how he saw a raven fly upside down, evidently to attract admiration from its mate. The bird rolled over sideways, he reports, fell a short distance in confused fashion and then continued to fly on its back, some five or six feet below the other bird. It flapped its wings and traveled in what appeared to be level flight. After flying in this position for a considerable distance, it righted itself and flew in the normal manner, Evershed narrates. Seagulls have been seen to turn somersaults in the air, the equivalent of an outside loop, but such maneuvers are probably accidental and more often displayed by young gulls that encounter a sudden air current that tips them over.

EFFICIENCY OF ENGINES AIDED BY THERMIC SIPHON

Possible savings of $25,000,000 annually in the operation of 40,000 locomotives may be realized through use of the thermic siphon, a device applied in the fire boxes to stimulate the circulation of water within the boiler and to accelerate the transmission of heat from the coal to the steam. In tests with a locomotive at the University of Illinois, it was indicated that the thermic siphon makes possible a gain of eight and one-half per cent in efficiency. In other respects, aside from generating more steam per pound of coal, locomotive performance is substantially the same.

GILDED BALL ON CHURCH SPIRE SEATS EIGHT PERSONS

Erected more than 150 years ago, an English church of several unusual architectural features is surmounted by a gilded ball on its spire. Inside the great golden sphere is a circular bench which comfortably seats eight persons. Access to the interior of the ball is gained by climbing a ladder from the tower up the outside of the spire.

Huge Gilded Ball on an Old English Church; a Bench inside the Sphere Seats Eight Persons

Automatic Dairy Which Delivers a Mug of Milk When a Coin Is Deposited and a Handle Turned

COIN-IN-SLOT DAIRY DISPENSES MILK AUTOMATICALLY

Milk has now joined the long list of food articles dispensed by automatic machines. A coin-in-the-slot machine pours out a mug of cool milk when a penny is dropped in it and a handle is turned.

CHEMICALS ACT AS SUBSTITUTE FOR GROWTH VITAMIN

Iron, iodine and fats in combination have been found to act as a synthetic substitute for vitamin A, the growth factor. In experiments at the University of West Virginia thus far, the substance has been tried only on rats, and the results were obtained by feeding them with meals ferrous oxide, containing iodine and iron, and linoleic acid, which has the fats. Apparently the chemicals contained about the same substance as vitamin A, for animals which otherwise would have died for lack of this vitamin were kept alive for many months by feeding them ferrous oxide alone. On the iron diet they failed to grow, but when fats were added, they showed improvement in three days and put on weight. Another experiment recently indicated that fatty acids from coconut oil serve as a substitute for vitamin B, the nerve factor.

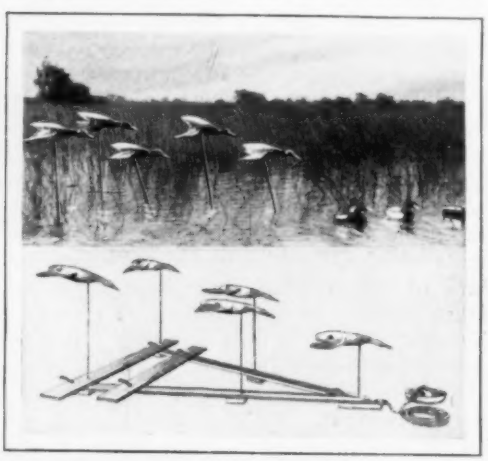
Fuselage of Wrecked Airplane Mounted on Runners and Powered by Airplane Motor; the Craft Makes Seventy-Five Miles an Hour

PLANE FUSELAGE ON RUNNERS BECOMES AN AIR SLED

Removing the wings from a wrecked airplane and mounting the fuselage on runners, two Michigan youths have constructed an iceplane or air sled capable of a speed of seventy-five miles an hour. The craft is driven by a sixty-horsepower airplane motor, and the controls are the same as were employed in the airplane in its original form.

FLYING DECOYS LURE DUCKS TO SURFACE OF WATER

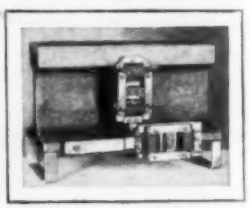
On the principle that flying ducks always gather, decoys that appear poised in flight now are offered as an added inducement to coax the birds within gun range. A set of flyers consists of five birds which can be obtained in various species. The outfit includes a triangular frame to which an anchor and rope are attached. The decoys are placed on upright rods which fit in holes in the frame.



Flying Duck Decoys Set on Upright Rods on a Raft Prove Better Lure Than Floaters

DEVICE REGISTERS STRAIN ON RAILS

To measure the strain on railroad rails, a magnetic gauge, easily adjusted and simple to read, has been introduced. It is also useful in determining the strain on members of buildings, bridges and other units. The gauge is so connected, when used on the rails, for instance, that the strain to which the rail is subjected, is converted into terms of electrical current on a recorder where readings or photographs can be taken. Undue stresses are thus quickly determined. The instrument, developed by engineers of the Westinghouse Electric and Manufacturing company, is expected to prove of great service in detecting unsafe tracks, bridges and other structures.



STRONGER AUTO WHEEL RIMS HAVE "DROP CENTERS"

Automobile wheel rims that are stronger, truer and enable easy tire changing are being developed as the result of extensive experiments with various rim types. Known as the "drop-center rim," the new wheel part has its center portion between the two tire-bead seats depressed so as to be smaller in diameter than the edges. This provides a well into which the tire beads are dropped when changing tires, the change being made in much the same way as with the plain clincher rim, which had a tendency to produce rim

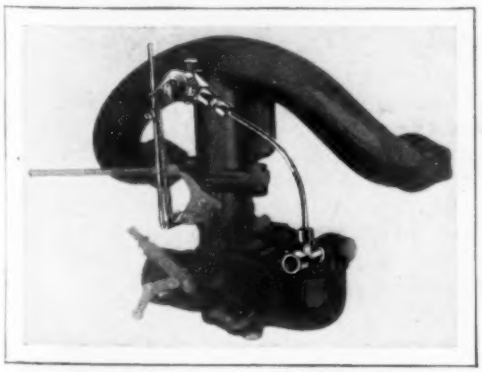
cuts. Its successor, the straight-side tire, has required the use of detachable side flanges or split rims. The split or straight-side rims give difficulties in removal, a trouble not encountered with the drop-center ones.

MORE USES FOUND FOR ZINC IN MAKING AUTOMOBILES

Zinc is playing an increasingly important part in the manufacture of automobiles. Rolled, cast and extruded alloys of the metal are replacing more costly substances because of their lower cost and superior mechanical qualities and resistance to corrosion. Hub and tank caps and running-board moldings are being made of rolled zinc, plated with chromium. Die-cast alloys of the metal with copper, aluminum and other materials, are being used successfully for gears and windshield frames. Zinc-plated iron is coming back into favor, as it has been found more resistant to corrosion than some of the more expensive materials.

AUTO "POWER BOOSTER" GIVES BETTER ACCELERATION

To provide more perfect combustion of gasoline and eliminate fuel waste and engine wear, a power booster for the automobile carburetor is being offered. This simple device, in the form of an auxiliary air and gas feed, can be attached in a few minutes to the manifold and is operated automatically by the foot accelerator. The power booster provides quicker pick-up, more speed and a smoother, quieter motor, with a saving in oil as well as fuel.



Power Booster for Automobile Carburetor Which Saves Fuel and Gives Better Acceleration

Fearing Depression, Berlin Tobacco Merchants Employed This Outfit to Advertise Their Wares

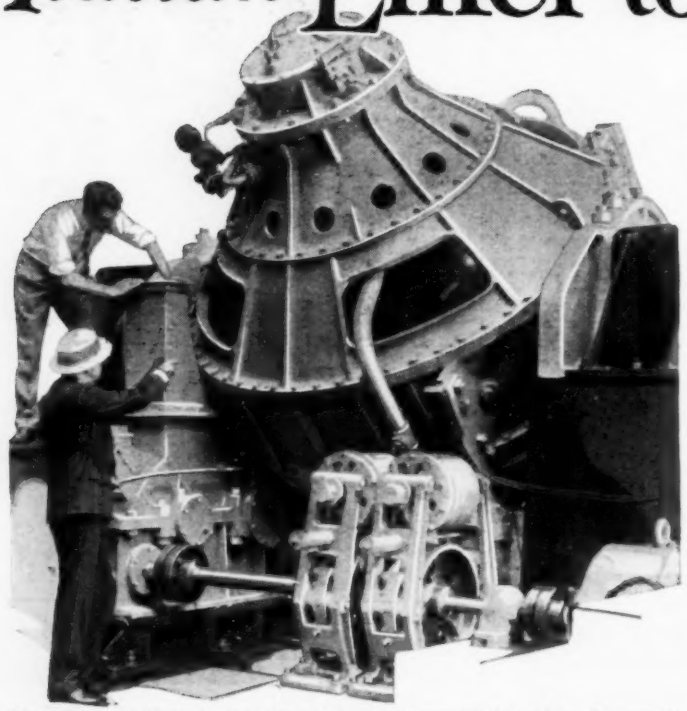
STILT WALKER RIDES BICYCLE TO BOOST SALES

Berlin tobacco merchants, anticipating an increase in taxes on their goods, adopted novel means to boost the sale of their wares recently. One shop hired an expert stilt walker to ride an elongated bicycle about the streets. The idea proved doubly effective. It not only attracted attention to a brand of cigarets, but emphasized the fact that higher taxes were imminent.

RADIO RECEIVER IN A PILLOW REPLACES EARPHONES

Intended for use in hospitals and Pullman cars, a radio pillow containing a reproducing unit has recently been brought out. The pillow is of regulation size and is made of sponge rubber in which a sensitive receiver is concealed. It is so constructed that, although the sound permeates the pillow, it cannot be heard except by resting the head on it. It can be used instead of earphones and also replaces the loud speaker, which may disturb others.

Italian Liner to Defy



Close View of One of the Huge Gyro-Stabilizers Which Help Counteract Wave Motion to Insure a Smoother Ride on Vessel

By DON GLASSMAN

WHO believes that a thing no larger than an apple can steady a barrel?

If the barrel were floating on rough water and the apple made to spin within, it would have a steadying effect on the barrel.

Thus you have stabilized a barrel with an apple. The principle is ancient and was first demonstrated in 1851 by a French genius, Foucault, who built the first gyro-compass.

Forty gyro-stabilized ships sail the high seas, the largest a 10,000-ton man of war. While others pitch and dance, these vessels brush aside rollers as if they were fleas.

What prevents most people from taking voyages is, of course, the dread of seasickness. No matter how palatial and comfortable your floating home, this nausea damages happiness and health.

Now the Italians have come to the aid of travelers with a sample of adventurous enterprise. They have contracted with the Sperry Gyroscope company for three stabilizers, the largest ever built, to steady the new 45,000-ton "Conte di Savoia," now under construction at Trieste. Thus the Lloyd Sabaudo line plans to invest a cool $1,000,000 to minimize illness and maximize passenger comfort.

The size of this order is prodigious. We have, first, a ship exceeded in size by only seven others in the world. The gyro units, weighing 900 tons together, will be expected to stabilize a 45,000-ton mass. Thus we strike this equation: Nine hundred tons of stabilizing machinery equals two per cent of the ship's displacement.

News of this installation threw a bomb into the shipping industry. So long as all companies steer clear of special innovations, the merchant marines remain on a basis of equality. But let one seize an improvement and proceed to place it in operation, and the others begin to sniff in half-terror. Thus it was when the "Bremen" flashed across the headlines with her blunt bow. Every greyhound now planned or under construction has a similar bulbous bow.

But the miracle of a stabilized passenger vessel surpassed that of a bulbous bow. Heretofore gyro-stabilizers have been employed only on private yachts, on aircraft carriers and destroyers. All merchant mariners await the trials of the "Conte di Savoia." To make a prediction, which is hardly bold, if this great ship

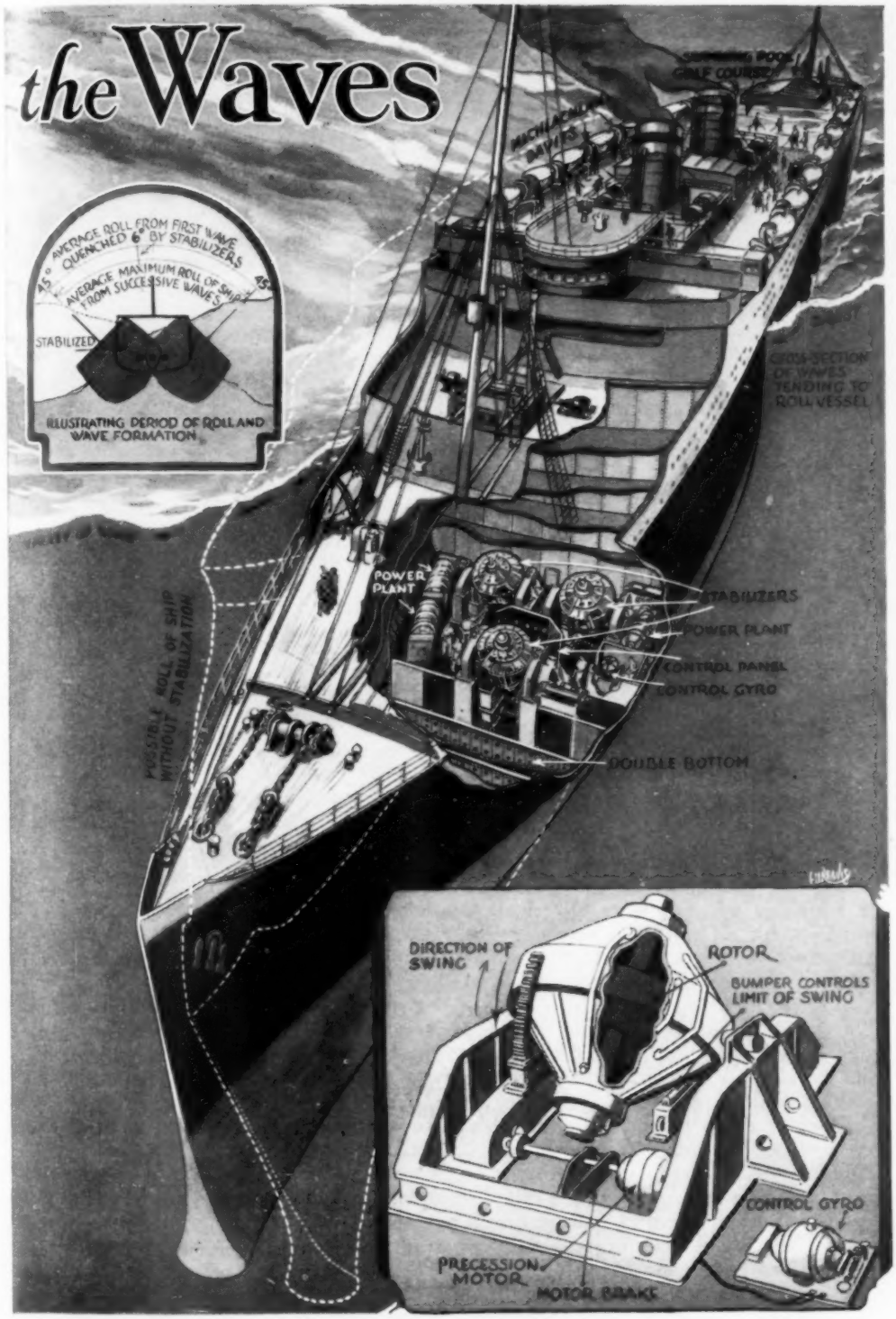
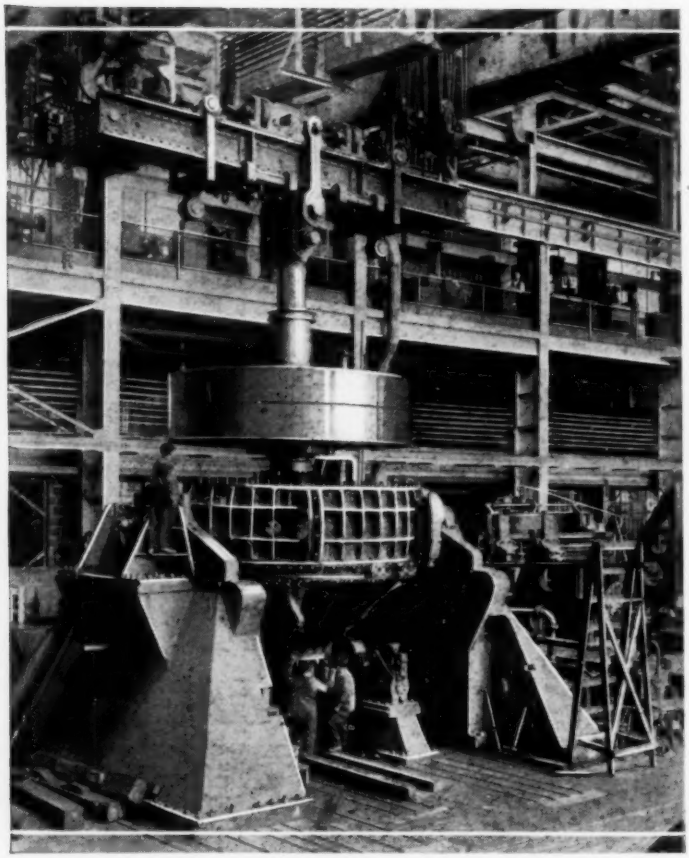


Diagram Showing Position of Stabilizers in Vessel, Effect of Waves on Boat, and Sketch of Stabilizer with Its Motor and Gyro Control



Setting Up Stabilizer for 10,000-Ton Cruiser; the Gyro Wheel Is Thirteen and One-Half Feet in Diameter and Weighs 139,000 Pounds

overcomes pitching and rolling even moderately, the next five years will witness the adoption of stabilizers as standard equipment for all merchant marines. No man who anticipates the ghastly horror of seasickness will board a non-stabilized vessel if he can help it.

To build a single stabilizer for the "Savoia" would be impracticable. Single units are all right for yachts or 10,000-ton warships. But it requires three apples to stabilize a 45,000-ton ship. No ship afloat carries more than one of these apples.

The "Savoia's" three units will operate singly or together. For the moderate ocean swell, only one unit will be necessary; for fairly bad weather, two stabilizers; for stormy seas and battering waves, all three stabilizers will be turned on. Extreme flexibility is their great advantage. In ideal weather, such as may prevail on the South Atlantic, a ship requires no stabilization; but nine-tenths of the time passengers are discomforted by tipping decks.

"Turn off the waves," will be the captain's order hereafter. And to execute the command, one of his subordinates will merely throw a switch. The ship fools Neptune, who stirs the deep.

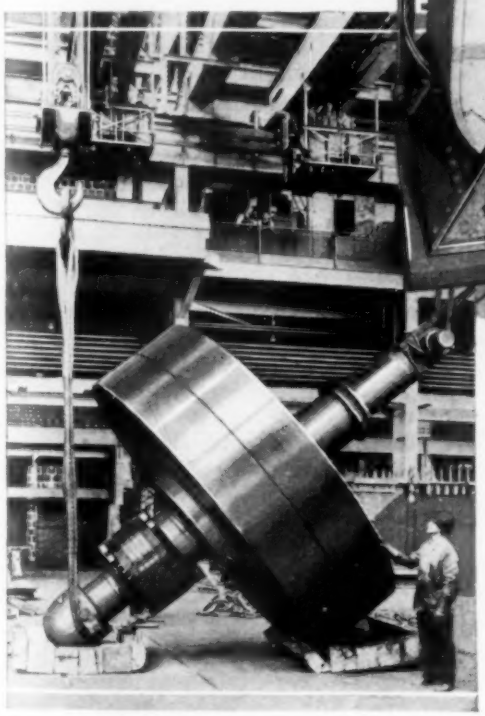
There is the story of an American yachtsman who hired a local pilot to steer his ship into a foreign port. While still in open water, the skipper ordered the "waves turned off." The pilot suddenly found himself standing on a floor as stable as a sidewalk. He dropped the wheel, ordered the engines stopped and turned to the yachtsman, saying pathetically: "We've run aground!" When shown the apple spinning in the barrel, he shook his head. It looked fishy.

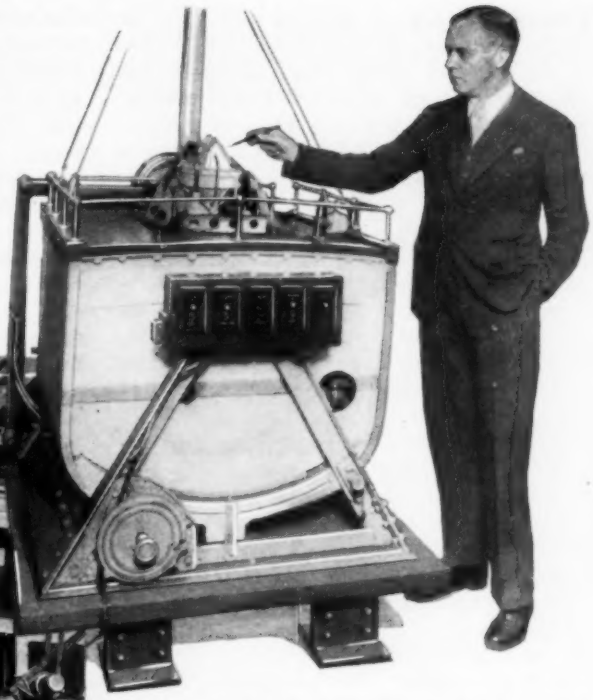
The stabilizer can be turned on and off just like an elevator. When off, it stands silent and rigid like a dumb robot. The three units for "Savoia" will stand on the ship's double bottom, in the forward end, right below the bridge, in what corresponds to hold No. 3. The units will extend above F-deck and halfway up the wall of E-deck. The floor arrangement of the gyros will correspond to an isosceles triangle, the altitude of which will be twenty-five feet. At the base, the gyros will be about seven feet apart. The switchboard will be at the heart of the triangle, which will be flanked on the port side by three control gyro units, and on the starboard side by the generating machinery.

The three small gyros will control the larger units by electrical connections. The smaller mechanisms will naturally

be more sensitive and respond quicker to rolling. The controls can be so adjusted that the slightest tipping of the ship will direct the gyros which way to apply force.

The gyro is essentially a balanced flywheel inside a casing. This flywheel, called a rotor, makes 750 revolutions per minute and measures thirteen feet in diameter. It is balanced with high





Thomas A. Morgan, President of Sperry Gyroscope Company, Demonstrating Action of Stabilizer, and Close View of Rotor

precision, so that a coin can stand up on its casing. Its weight is 100 tons. The casing is kept airtight in order that the rotor may spin with the least air friction.

Spin these 100-ton rotors at 750 revolutions, and they acquire stupendous amounts of thrust and force energy. If the wheel axle is turned in one direction, it resists, and turns instead at right angles applying the force on bearing gears at the ends of the axle.

The ship frame receives the thrust. A great ship does not take to rolling suddenly. It gains momentum like a swinging pendulum, the first swing having a longer amplitude than the preceding swings, until a maximum is reached. If the pounding of rollers grew stronger progressively, the vessel would be thrown over on her beam ends and capsized.

The gyro goes into action at the very word "roll." The first feel of a tipping foundation starts the rotor turning. By stifling the first roll and the second, etc., the gyro never allows the waves to throw the ship out of control.

For every thrust from the waves, the gyro delivers a counterthrust. It is a blow-for-blow battle. Round in, round out, the gyro retaliates, never missing, always cool and courageous. By quenching rolling at its beginning, a small gyro is thus able to control a mammoth ship. The wave passes under the hull, and the gyro is ready for the next one. In holding the vessel from listing, the stabilizer does the same work as gradually lifting a weight from one side of a ship and gently placing it on the other side.

In addition to giving comfort, the stabilizer decreases stress on a ship's hull. A stabilized vessel does not creak and groan. An ordinary vessel rolling in a seaway

accumulates a great deal of strain on the ship's superstructure. There is a sympathetic bond between rolling and pitching. Although the gyro has no direct control over pitching, the reduction of rolling automatically minimizes the forward plunge and dip.

To accomplish all this on the new "Savoia," her generators will have to deliver only 1,500 horsepower to the three stabilizers. With these stabilizers, a ship in perfectly calm water can be made to roll violently—experimentally, of course. In rough water a twenty to thirty-degree roll can be reduced to one and a half degrees.

Ships left to themselves, plow and wallow through heavy seas. It is difficult to steer them on straight courses. Stabilized ships can be held to any point of the compass. Ships are said to roll because "they have nothing else to do."

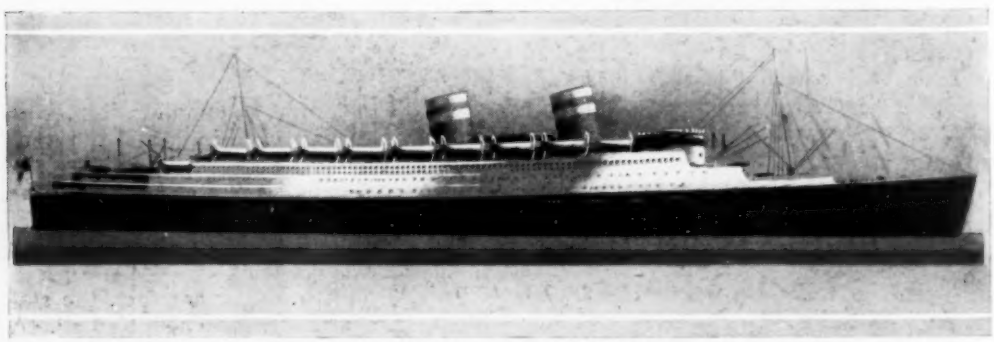
The strains forced on ships by waves are stupendous. There is one instance of a large vessel having been broken in two by a terrific wave. The wrenching, twisting movements of choppy seas are estimated to exert as much as 2,400,000 foot-tons on a vessel of large displacement. When wave crests are at both ends of the ship and the middle sags, the strain is said to equal 1,050,000 foot-tons. Hence the shipping world awaits the "Conte di Savoia" with more than ordinary suspense. Aside from her ultramodern stabilizing equipment, this greyhound will embody the latest improvements, a number of which are made possible by her gyros.

Her top deck will be so steady that it will have a great swimming pool inclosed by glass admitting ultraviolet rays from the sun. The pool will be aft of the twin funnels, and around it will be laid out a miniature golf course. This pool may be used in all kinds of weather because the stabilizers will maintain constant equilibrium. There will be another pool between lower decks for the use of second and tourist classes.

The "Savoia's" hull design will not only embody the bulbous bow but other refinements now being worked out in the test pool at Hamburg, Germany. Her outboard profile will extend 820 feet. The beam will be ninety-six feet. Her silhouette will appear rakish and jaunty. Short, stubby funnels will lean back to preserve the streamline effect.

Another notable feature of this ship will be the absence of the third, or dummy, funnel. Most passenger greyhounds have included it, merely to balance the superstructure and to give the ship an appearance of greatness. But the Lloyd Sabaudo architects believe that the day when a passenger stops to count funnels is past, and they are aware that a modern electrically propelled ship might just as well do away with all her smokestacks. What happens when you eliminate the rear funnel? First, the ship acquires the lines of a destroyer. The funnels forward of the amidship section give her a larger head, so to speak. To the rear of the funnels, the decks sweep back in long graceful lines that taper off gradually to the taffrail.

But the passengers gain when the dummy funnel is absent. They acquire an amazing area of free space on the top deck, exposed to the sun and sky without hindrance. And on the new "Savoia" they will have the largest open deck space on



Drawing of the "Conte di Savoia" Palatial Italian Liner; the Stern Funnel Was Eliminated to Help Increase the Deck Space for the Convenience of Passengers

any steamer afloat. She will have the first full-size tennis court, the first all-weather swimming pool, and the first miniature golf course.

When the $15,000,000 "Savoia" slips down the ways in the spring of 1932, Italy will have launched the first of a fleet of superships which will surely have a place in maritime history. The "Savoia" will make her maiden voyage between New York and Naples in the fall of 1932. Her guaranteed speed will be twenty-seven and a half knots, but she will probably develop several knots more. When she is launched, at any rate, she will have heels at least as fast as any passenger vessel afloat. Thus she will cover the New York-Gibraltar run in five days (equivalent to the New York-Cherbourg run of other vessels) and add two more days to her schedule for the voyage from Gibraltar to Naples. By a recent arrangement, however, passengers will be able to reach Naples or Rome only five and one-half days after leaving New York. A seaplane service from Gibraltar to Italian ports, covers the distance in half a day.

MOISTENER THAT WON'T BREAK MADE OF RUBBER

Made entirely of rubber, an unbreakable moistener for the desk operates at the press of a button. It contains a hollow handle of semisoft rubber and a tip into which a piece of sponge rubber fits. The top end is covered by a soft-rubber cap, in the center of which is a hard rubber rod that forms part of a valve arrangement. When the handle is filled with water and the cap is pressed, several drops are released on the sponge. When not in use, the moistener fits into a rubber cap that serves as a support and prevents evaporation.

The longest air route with a regular service of planes is from New York to Buenos Aires, a distance of 5,880 miles.

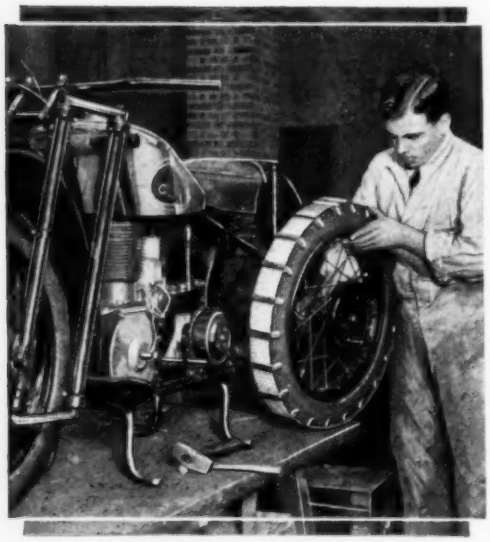
Oxygen Tent and Tank for Treating Pneumonia and Other Lung Maladies; No Motor Is Required

OXYGEN TENT AIDS TREATMENT OF LUNG DISEASES

Devised especially for treating persons suffering from pneumonia and other lung diseases, an oxygen-breathing tent is said to be an improvement over similar units of its kind as it needs no motor. "Dry ice"—carbon-dioxide snow—is used for cooling, and the oxygen is released and mixed with air from a portable container. As air comes from the hood in which the person is placed, it is regenerated by passing through a small soda-lime container. The amount of oxygen can be regulated and the temperature can be kept nearly constant.

PHONE DIAL WITH REGISTER SHOWS NUMBER CALLED

On the dial of the automatic telephone is a register which shows the number called so that the user can tell if he has made a mistake without waiting for the connection to be completed. If an error has been made, a button is pressed which breaks the circuit and clears the instrument for another call.



Cotton Belt on Rear Wheel of Motorcycle Adds to Rider Comfort and Increases Traction

BELT ON MOTORCYCLE WHEEL ADDS TO RIDING COMFORT

British motor cars, and a motorcycle unit making a 12,000-mile trade-exhibit tour from England to Africa, have been fitted with many special devices to add to the comfort and safety of members of the expedition. The cycle which will lead the tour as a scout when the party crosses the desert, has a woven cotton belt attached to the rear wheel, tubular framework to add to its strength, and extra-large gasoline tanks. The wheel cover not only protects the tire, but adds materially to the comfort of the rider in traveling rough country.

"SUB-ZERO" ICE IS SHIPPED FROM TROPICS TO U. S.

"Sub-zero" ice, manufactured and shipped from the tropics, is arriving in New York in cork-insulated holds of steamships, and offered to ice-cream and refrigerating companies for $80 to $90 per ton, about equal to the price of domestic "carbon" ice. The ice arrives in port at a temperature of 109.3 degrees below zero, and is immediately placed in a warehouse, whence it is delivered to consumers. It analyzes 99.9 per cent carbon dioxide, and this high degree of purity renders it perfectly odorless and satisfactory for preserving any food. Sub-zero ice derives from reclaimed gas wells in the Tampico-Quebrache oil field, in Mexico. One of these wells, drilled in 1925, began blowing 200,000,000 cubic feet of carbon dioxide into the air daily. James W. Martin, a consulting engineer, is largely responsible for the process by which natural carbon dioxide is made into ice. He invented a method of purifying the gas by high-pressure absorption; secret chemicals remove the hydrocarbon impurities. When the gas comes out of the earth, it has a temperature of 100 degrees. It is cooled by contact with cold water, and soon liquefies. When squirted through a nozzle, using the gas pressure of the well itself, about one-third of the liquid turns to carbon-dioxide snow. Laborers shovel the snow into metal tanks and pack it closely. Each tank holds 300 pounds of snow, which after recrystallization makes about five cubic feet of carbon-dioxide ice. This product weighs seventy pounds per cubic foot, as against fifty-six pounds per cubic foot for water ice. Sub-zero ice placed in freight cars, can within an hour increase the carbon-dioxide content of the air to the extent that fruit rots and softening of ripe fruits are checked in the same degree as by a drop in temperature of thirty to forty degrees.

CARRIAGE WITH SINGLE WHEEL RUN BY MAN-POWER

Residents of Seoul, Chosen, who take a ride must be adept balancers because the popular carriage is a one-wheeled

Adept Balancing Is Necessary to Ride on This Single-Wheeled Conveyance Run by Man-Power

vehicle. A seat for one passenger is placed high above the single wheel on a frame containing shafts fore and aft for pulling and pushing. Loss of balance is likely to spell disaster for the rider unless his servants are proficient.

HEATER FOR RAILWAY SWITCH MELTS ICE AND SNOW

Accumulation of snow and ice around railway-track switches is prevented by an electric heater, consisting of an iron casting about a yard long in which is inclosed a nickel-chromium heating element. The unit is placed beneath the switch frog or rail and current is supplied from lines that operate automatic signal devices. It is estimated that a dozen units are needed for each switch to supply the proper amount and distribution of heat, these units replacing the large forces of men often required to keep the switches working.

SAFETY SWITCH STOPS ENGINE ON MOTORCYCLE

Intended particularly for police motorcycles, a mercury switch shuts off the engine automatically when the machine is placed on its side. A tiny ball of mercury running in a sealed tube operates the switch. It does not cut out when the motorcycle is banked on a sharp turn or on a rough road, but the ignition is cut off the instant the machine is laid down. It is easily attached and provides an added safety factor when a motorcycle officer must dismount suddenly, or leap from his machine to the running board of a car he is overtaking.

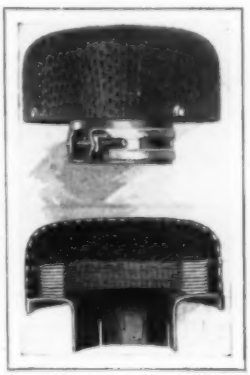
SALVAGE OLD AUTO TIRES FOR USE IN EUROPE

Large quantities of old automobile tires are salvaged every year, but it is not generally known that tons of them are exported for sale in foreign countries. The accompanying photograph shows a few awaiting shipment for Germany at Los Angeles.

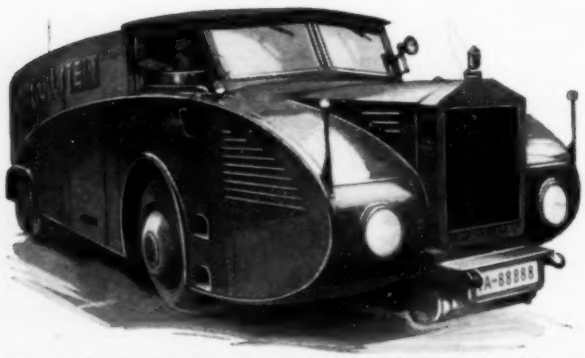
Pile of Old Automobile Tires in Los Angeles, Awaiting Shipment to Germany

FLAME ARRESTER ENDS DANGER OF BLAZE FROM BACKFIRE

Blazes from backfire sources are prevented by a flame arrester which can be attached to the intake of any carburetor in either an automobile or motorboat. It prevents carburetor backfires from reaching the outside air and igniting inflammables beneath the hood of the car or fumes from bilge of a boat. The arrester cools the hot gases as they are forced through a series of evenly spaced steel plates.



¶ Names of manufacturers of articles described in this magazine will be furnished free by our Bureau of Information.



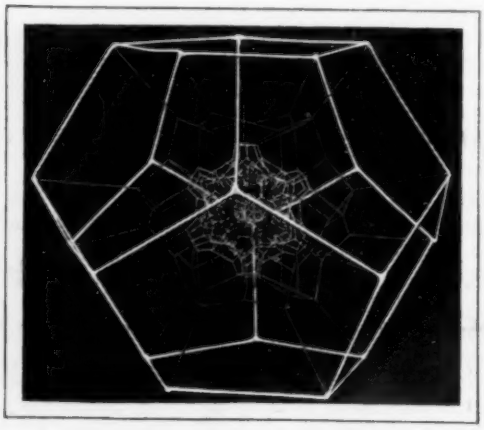
Not an Armored Tank, but a Six-Wheeled Truck Used by a German Publishing House for High-Speed Deliveries

MOTOR TRUCK LIKE WAR TANK HAULS GERMAN PAPERS

Resembling a huge armored tank, but devoted exclusively to peaceful pursuits, a big six-wheeled truck is used by a German publishing house as a fast transport car for papers, books and magazines. It has a streamlined body and is operated by 100-horsepower motor. Oval-shaped sections on each side add to its tanklike appearance, resembling tractor chain treads.

MODEL OF FOURTH DIMENSION LIKE A LAMPSHADE FRAME

Resembling somewhat the wire frame of a lampshade, a model representing the fourth dimension of space has been constructed by Dr. Paul Heyl, of the bureau of standards. Most persons' mentality can deal with only line, plane and space, or length, breadth and thickness, so that any fourth dimension dealing with space or time must be left mostly to the imagination. The model is in the form of a regular polygon and inside of it an intricate symmetrical figure.



© Acme—P. & A.

This Wire Frame, Looking Like a Lampshade, Is a Model Representing the Fourth Dimension

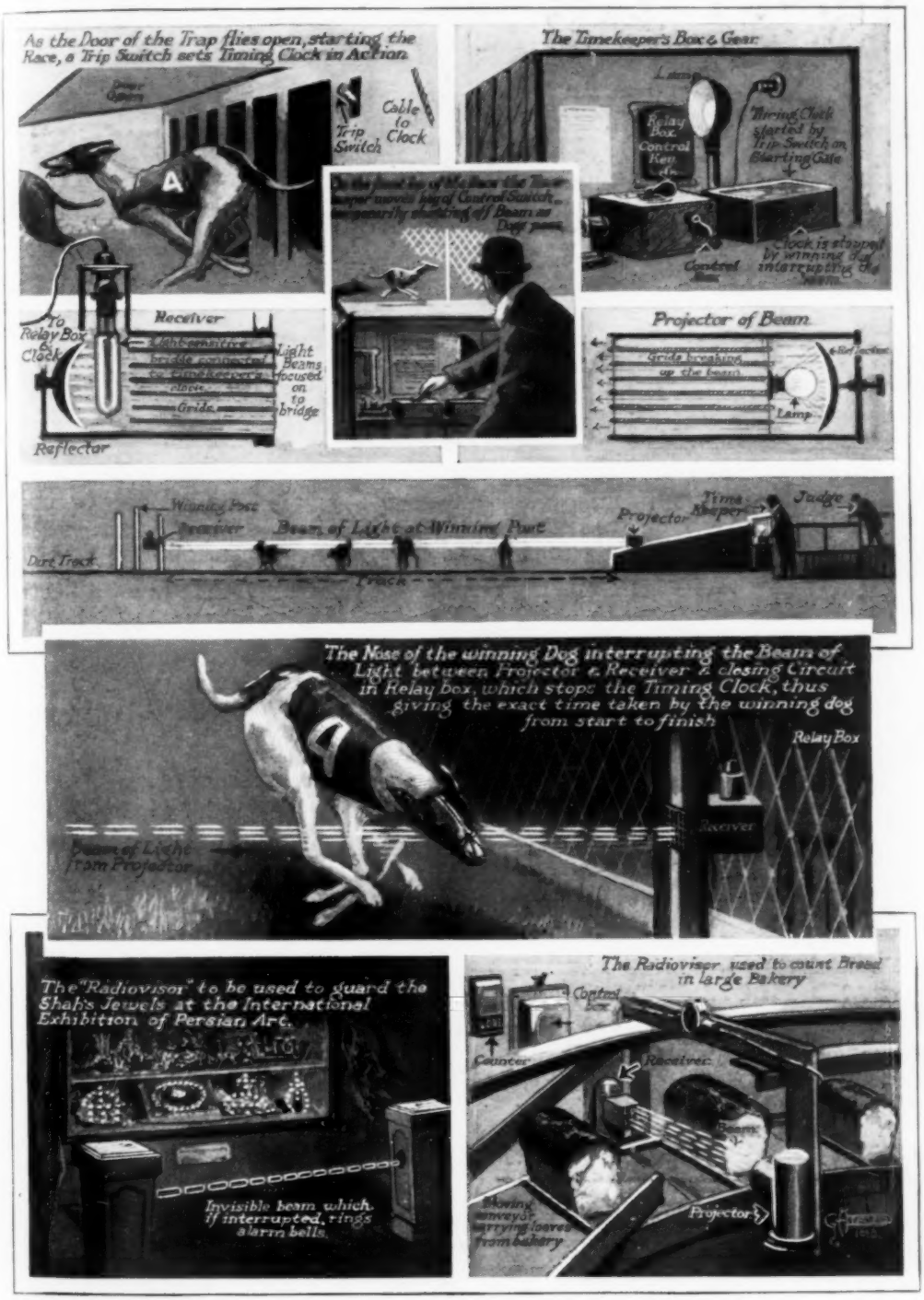
DRAIN VALVE FOR AUTO PAN SIMPLIFIES OIL CHANGE

Draining the auto oil becomes a task that any motorist can do himself without having to go to a service station if he has provided himself with a recently introduced valve which can easily be reached from the side of the car without crawling under it. A pair of pliers or a slotted stick is the only tool required for mounting and the valve is so designed and placed that it cannot very well strike anything on the road and thus open accidentally even when driving on rough highways. A lock washer prevents its working open.

SELF-OILING BEARING MATERIAL LIKE A METAL SPONGE

Self-lubricating bearing material that eliminates squeaks and excessive wear and minimizes friction has been produced by Chrysler motors engineers who have named the material "oilite." It is an alloy of copper, tin and other metals, and is subjected to tremendous pressure, heat-treated and then impregnated with hot oil in a vacuum. It absorbs up to forty per cent of oil by volume and has great strength. Due to the high oil content, a hydraulic cushion exists that permits loads in excess of those carried by conventional materials, making the self-oiling bearing superior to high-grade cast bronze where severe duty and high pressures are encountered. It imparts a high polish to shafts, instead of scoring or tearing them and is particularly useful in spring shackles and on steering gear cross-shafts.

LATEST WAYS BEAMS OF LIGHT ARE PUT TO WORK


As the Door of the Trap flies open, starting the Race, a Trip Switch sets Timing Clock in Action
Trip Switch
Cable to Clock
The Timekeeper's Box & Gear
Relay Box
Control Key
Timing Clock started by Trip Switch on Starting Gate
Clock is stopped by winning dog interrupting the beam
Receiver
To Relay Box & Clock
Light Beams focused on bridge
Grids
Reflector
Projector of Beam
Grids breaking up the beam
Lamp
Winning Post
Beam of Light at Winning Post
Projector
Time Keeper
Judge
Dirt Track
Track
The Nose of the winning Dog interrupting the Beam of Light between Projector & Receiver & closing Circuit in Relay box, which stops the Timing Clock, thus giving the exact time taken by the winning dog from start to finish
Relay Box
Receiver
Beam of Light from Projector
The "Radiovisor" to be used to guard the Shah's Jewels at the International Exhibition of Persian Art.
Invisible beam which, if interrupted, rings alarm bells
The Radiovisor used to count Bread in large Bakery
Control Box
Counter
Receiver
Projector
Showing conveyor carrying loaves from bakery

© The Illustrated London News

Timing Dog Races, Guarding Jewels and Counting Loaves of Bread; Three of the Many Tasks That Have Been Found for the Photo-Electric Cell

LIFE-SAVING SUIT HAS HOOD TO PROTECT THE FACE

Testing the New Life-Saving Suit Which Permits the Wearer to Remain in an Upright Position While Floating; Note Breathing Equipment and the Hood That Completely Covers the Face

Wearing a life-saving suit developed in Italy, victims of shipwrecks are able to float in a vertical position and also have a hood that protects the face. In case of heavy seas, this hood can be lowered to give complete covering. The person breathes through a special mouthpiece arrangement, fitted with air valves.

NUMBER OF LICENSED PLANES AND PILOTS INCREASING

Substantial growth was shown in 1930 in the number of licensed pilots, aircraft and mechanics. Department of commerce records show that at the beginning of 1931 there were 385 licensed women pilots among the 15,280 holders of pilots' licenses, while the group of 8,993 mechanics included five women with licenses. In addition to 7,354 licensed aircraft, there were 2,464 without such credentials, Illinois having the most unlicensed ships. On Jan. 1, 1930, there were 10,215 licensed pilots, 6,685 aircraft and 7,624 mechanics. The number of unlicensed aircraft decreased in 1930, and California led in the number of licensed pilots with 2,852.

ELECTRIC HEATER WITH A FAN CIRCULATES WARM AIR

Inclosed in a metal cabinet, an electric heater that employs a fan to circulate the air is capable of heating a large room quickly. The heater is simply plugged into a light socket, and the fan draws the cold air from the floor, blows it past the electric heating elements and out into the room. The heater is also convenient for drying the hair or clothing.

¶Briar pipes are made from heather roots grown in southern Europe.

TELEPHONE USERS ARE SERVED BY SUPER-ROBOT

When one of the 10,000,000 people in greater New York picks up a telephone receiver and asks to send a Western Union telegram, the operator switches the customer into one of 120 trunk lines leading to the telegraph company's headquarters. The customer is then in the hands of a robot. This magic apparatus, described as an "automatic call distributor," has been placed into operation after two years of experimentation in the Bell Telephone laboratories, which owns the patents. The robot receiving unit provides the speed of lightning and "brains" to machinery. Even before it receives a call, it knows which of the 110 girls is prepared to receive it. Not only that, it distributes these calls equally, so that during the course of a shift, every girl receives the same number of messages. The largest crew of message-taking operators in the world, 110 of them, are arranged in three groups. After the robot has selected the proper group, it sets into motion a rotary switch which hunts over the terminals and connects the customer to the first idle line. The average call receives attention in one second or less. The recording operators sit at long desks in a room insulated against all outside noises. Each girl operates a noiseless typewriter and speaks through an individual transmitter. In her idle moments, she does not have to watch any lights as with the old switchboard. The robot warns her to get ready with a double buzz in the earphone. She immediately speaks and proceeds to type the customer's words on a telegraph blank. The supervisor has learned many things about the telegraphing habits of people. Most calls originate between 10:00 and 11.00 a.m. and 2:00 and 3:30 p.m. On holidays, a great many messages are sent in the morning. And more people telegraph on rainy than on fair days.

Boat with Double Hull Operated by Hand, Sails or Motor

BOAT WITH DUAL HULL DRIVEN BY HAND, SAIL OR MOTOR

Three types of power are available to propel a sixteen-foot boat whose hull consists of two buoyant pontoons of great stability. Hand propulsion, sails or an outboard motor may be used. The hand mechanism is forward in the cockpit and, just aft of the forward deck, is the operator's seat which slides back and forth like that in a racing rowboat. In front of the operator is a driving rod to which a handle is attached. When drawn back gently, as an oarsman pulls his oar, this rod spins the propeller, located beneath the operator driving the boat forward. At the end of the stroke, the rod returns forward, while a flywheel maintains the constant speed of the propeller. Steering is done by the feet, operating at once the rudder and propeller.

New Conveniences

Blanket Bag for the Baby Has an Interlocking Fastener to Keep the Child Warm and Safe

Holder-Squeezer for Tooth-Paste Tube Saves Time and Waste

Above Is an Adjustable Wire Screen for Doors and Windows to Protect Children and Keep Out Prowlers

At Right, a Simple Device to Keep Water Pipes from Bursting if They Freeze; the Small Valve Attachment Allows for Expansion and Helps Prevent Freezing; It Is Easily Installed and Requires No Attention

Above, an Electric Fan, Adjusted in Front of a Register, Speeds Up Circulation of Warm Air in Winter and Cool Air in Summer When Hung in a Convenient Place; at Right, Portable Electric Clothes Washer That Operates from the Lighting Socket and Has No Moving Parts to Tear or Damage the Articles; the Necessary Motion Is Obtained by Pulsating Action of Air Bubbles, Soapsuds and Warm Water

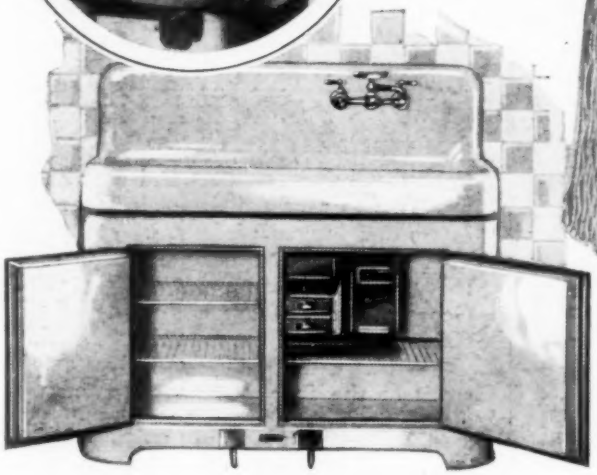
for Your Home

This Gaily Colored Bag Keeps a Ball of String Handily within Reach; Prevents the Cord from Becoming Snarled; as the String Is Pulled through Opening Below, the Ball Cannot Easily Fall Out; Metal-Rimmed Hole in Flap Fits Nail or Hook

At Right, a Sanitary Pasteurizer for Baby's Milk Bottles, and, Below, a Portable Oven for Stoves and Hot Plates Has a Top Door for Easy Access to the Interior

Brush and Dust Pan in One Save Stooping; the Pan Is Adjustable

Changing the Mop Rag Is a Matter of a Few Seconds with This Arrangement, as the Rag Slides onto the Holder Bar



Sink and Electric Refrigerator Are Conveniently Combined in Arrangement Shown at Left, Hiding Unsightly Pipes, Saving Space and Steps; the Doors Are Opened by Pressing Pedals at the Bottom; a Plain Exterior Simplifies Cleaning

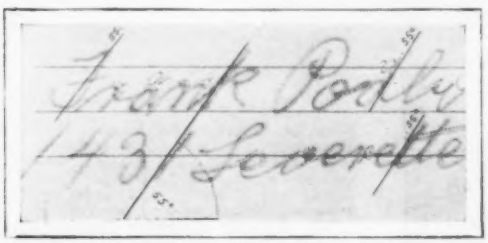
Windmill Tower Converted into Church; the Bell Is Suspended in Niche of Old Hub Opening

OLD WINDMILL AS CHURCH SERVES GERMAN PARISH

Out of service for some time, an old windmill in Germany was converted into a church. The tower was transformed into a small, but comfortable auditorium, and a bell was suspended in a niche below the top window, where the axle of the sails once turned.

CHART TEST FOR SIGNATURES TELLS WHICH IS GENUINE

Examining handwriting is one of the important phases of the work in the scientific laboratory of the Detroit police department, and comparison of samples by a chart method is often effective in revealing spurious writing and establishing the genuineness of other samples. Characters are subjected to minute measurements and other inspections. One of the first steps is to compare the angles of slant of various letters. This is easily done by means of a line parallel to the letter, as shown in the illustration. This does not disfigure the writing and permits easy comparison of specimens. Other letters are traced in an outline of dots, which is helpful in revealing any special characteristics that may give a clue as to the identity of the writer.



Handwriting Specimen Lined for Study; the Slant of the Letters Is an Important Feature

AUTOMATIC TIRE PUMP DRIVEN BY ONE CYLINDER OF CAR

Motorists now may carry their own air station in a pocket of their cars in the form of an automatic tire pump operated from one cylinder of the engine. It consists essentially of a length of hose with an attachment for the tire valve at one end, and at the other a connection to be inserted in a cylinder after a spark plug is removed. This makes an air compressor of the cylinder when the engine is idling. Air is admitted so freely through the valves that the suction in the intake manifold causes the gasoline to be held back so that only clean air can enter the tire.

LIGHT TREATMENT FOR FOODS CREATES VITAMIN D

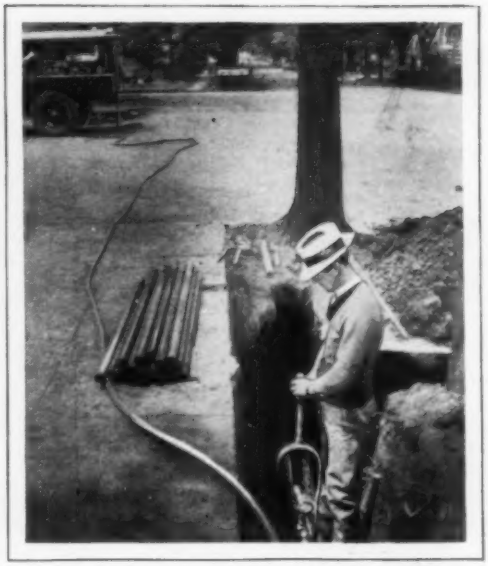
Ultraviolet radiation has been found to help preserve foods, enhance the bone-building vitamin content and enable food products to retain their fresh flavors and odors for longer periods. By exposing milk and other foods to narrow bands in the "rainbow" of invisible light, Prof. George Sperti, of the University of Cincinnati, produced the artificial antirachitic vitamin D without any offensive taste or smell in the foods. Foods treated with ultraviolet light act in all ways as though containing vitamin D, but by using only a part of the total band of light waves, much

larger quantities of the vitamin have been obtained. Filtered radiations promise to be effective also in preserving foods, as milk, orange juice and other products have been sterilized by exposing them to the narrow spectral limits of invisible light. Selective irradiation depends on the existence of a critical wavelength at which biological reactions begin. A given effect occurs with shorter wavelengths that contain more energy, but longer waves than the critical one are inactive. If yeast used in bread making is irradiated with a narrow frequency band of X-rays, unwanted mold cells, that would spoil the bread after being baked, are killed, while the yeast cells are unharmed.

CATTLE BLOOMERS AID STUDY OF NEW DISEASE

Bossy is being dressed in bloomers for the sake of her health. Scientists of the department of agriculture, engaged in studying anaplasmosis, a relatively new cattle disease, decided that common dog ticks carry the disease from one animal to another. To prove this, however, it was necessary to study the ticks for several generations. Their habits made it difficult to collect them, as the young live on the animal until time to molt, then drop to the ground. To get them when they dropped off, bloomers were made for several cows under observation. They are of white canvas, and have elastic suspenders attached to a collar about the animal's neck, allowing the cow to turn her head or body without getting them out of place. The legs are fastened with elastic garters to prevent the escape of the ticks.

Cow Being Fitted with Bloomers; the Garment Is Used to Collect Ticks for Scientific Study



Hydraulic Auger Which Bores Holes for Pipes under Streets without Disturbing Pavement

NEW BORING MACHINE AVOIDS TEARING UP PAVEMENTS

Tearing up streets and highways for the placing of pipes and conduits will be reduced to a minimum when a remarkable, patented hydraulic auger comes into use. It can bore under wide thoroughfares without previous trenching with all its unsightly and bothersome results. Automobiles have rolled unimpeded over the surface of the Redwood highway, for instance, while the boring was being made beneath for the placing of three-inch pipe. The tool is notable in that it has succeeded in overcoming the tendency of drilling a gradually declining hole. An operator can direct its bore with the precision of a marksman, at distances of forty feet bringing it out to within two or three inches of the point at which it is aimed. The machine is capable of boring at distances of 100 feet or more. Not only does the use of the implement obviate the necessity for cutting up streets and highways, but it also is used for laying pipe under gardens and buildings.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

Relics of Pioneer Days in Museum Established as a Result of Interest in Collecting Stamps of the Pony Express Era

TEN DOLLARS PAID FOR LETTER IN PONY EXPRESS DAYS

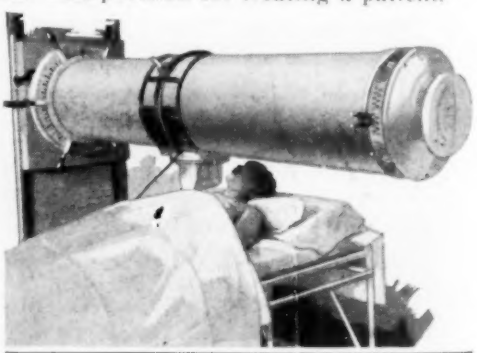
It was not uncommon in the gold-rush days of California for miners far up in the hills, to pay as high as $10 for the delivery of a single letter. Carriers took big bags of mail on their backs or by dog sled into some of the mining camps. Jerry Green, according to legend, once "packed" 60 pounds of letters as he trudged on foot from Nevada City to camps on the high divide. Interesting relics of the early days of the mail service in this country have been gathered and exhibited in a museum at Pasadena, Calif., by W. Parker Lyon, who developed his hobby from his enthusiasm in stamp collecting. Pioneer weapons, household articles, and many other objects, recall the days when the Pony express bridged the gap across the Rockies. It was officially started April 3, 1860, between San Francisco and St. Joseph, Mo. The schedule was made in less than eleven days, and the Pony riders continued to be on time and regular as long as the service was conducted. One of the most famous of its riders was Robert H. Hoslem, "Pony Bob." He made a continuous ride of 380 miles, whereas the usual galloping expressman rode seventy-five miles and wore out three horses before taking a rest.

TADPOLE'S HEAD HASTENS ROOT GROWTH

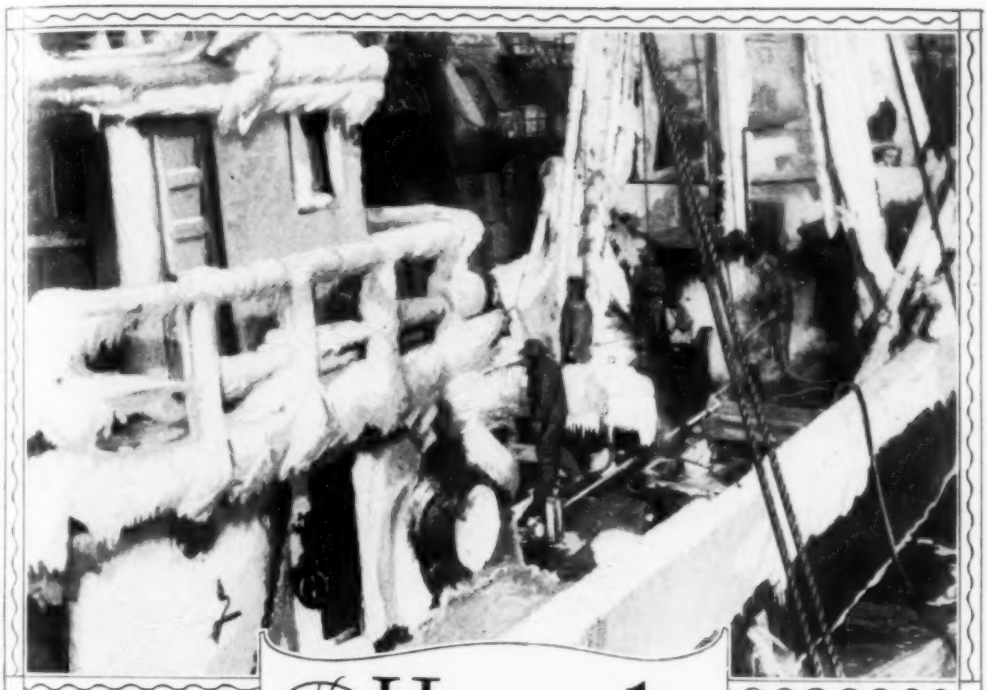
By pointing a tadpole's head at growing plant roots, experimenters at the University of Pennsylvania demonstrated that the roots grew more rapidly. Turning the tadpole around and pointing the tail, had no effect. The test suggests a bit of fanciful magic, but is explained by the theory that invisible radiations, given off by some living cells, stimulate the growth of other cells. The radiations have been reported from root tips, embryonic animal tissue, cancer cells and many other living things, although some investigators have obtained only negative results in the experiments, and doubt the existence of the emanations. The rays are believed to be of the same nature as the ultraviolet rays.

X-RAY GUN PROMOTES SAFETY AND AIDS TREATMENTS

Greater safety and ease in giving X-ray treatments are features claimed for a gun-shaped apparatus introduced in Berlin. An inclosed barrel, or chamber, is said to afford ample protection against unintentional radiation and exposure to high voltages, and the tube is easily adjusted to the best position for treating a patient.



Barrel-Shaped X-Ray Apparatus Which Can Be Moved to Many Positions and Shields Attendants



The Hazards of Winter Navigation

THE STEAM trawler "Foam" was a ghost ship that February night. White she was from stem to stern, from water line to mast top. Down from the Hudson bay country whistled a northwester, out over Massachusetts bay, bringing with it a temperature close to the zero mark.

The big waves smothered the bow of the little craft and, receding, each added to the burden of solid ice on her deck. The spray flew mast-high and congealed instantly when it struck spar or rigging. Lashed to masts and stanchions, the crew labored feverishly with ax and bar, to keep the scuppers clear.

Out of the door of the pilothouse, stuck the head and shoulders of Capt. Richard Tobin, his outer clothing frozen solid. Hours before, the freezing spray had covered the windows inches deep, and he had to stay outside to pilot the vessel.

When the "Foam" had sailed for Boston market, from Georges bank, early in the morning, she was already loaded deep, for fishing had been good, and 150,000 pounds of cod and haddock were in her hold pens. Even against the fast rising wind, she had made a good run homeward until she passed the tip of Cape Cod.

There the arctic blast caught her fair as it rose to full-gale strength and the thermometer dropped lower and lower. It's only forty miles from the tip of the Cape to Boston harbor—ordinarily but a few hours' run. That night, it took the "Foam" nearly fourteen hours to make the distance across the Massachusetts bay. Only one thing saved the "Foam" that night. Hose were run out from the boiler room and streams of boiling-hot water were played upon the ice.

What a Severe November Storm Did to a Freighter; the Vessel Was Driven against the Shore Almost Out of the Water, Only a Steep Bank Keeping It from the Trees

Not for a day, until late in March, will fishing craft be safe from north winds, zero temperatures and the threat of unwelcome loads of ice, for Massachusetts bay is considered one of the two worst bodies of water in North America for cold-weather navigation. The other is Lake Superior, where navigation closes about the middle of December and does not reopen until March. During that short period of fall and spring shipping, the greatest of the Great Lakes holds just as much menace for inland-water navigators as the New England bay does for those who ply their craft on salt water.

The couple of weeks just preceding the close of navigation is a period of frenzied activity on the Great Lakes, especially on Superior. The eastern blast furnaces need a lot of iron ore to keep them going during the winter months. Hundreds of thousands of bushels of grain are arriving daily from the western fields, and the dock elevators are full almost to overflowing. Europe will need every bushel of wheat that can be shipped before the freeze-up.

In that last grand rush, over a quarter-million tons of iron ore have been shipped from the Duluth-Two Harbors ports in a two-day period. More than a score of freighters took 86,747,000 bushels of grain out of the twin ports—Fort William and Port Arthur, Ontario—in one day late in November.

Again, in the early spring, the rush begins as soon as the ice goes out of the rivers that join the lakes. The iron-ore stock piles at the furnaces are getting low and the east is crying for wheat. Elevators at the head of the lakes are fairly bulging with grain and the interior is demanding storage facilities.

At the first sign of the ice rotting, the big icebreakers get busy and clear the river at Sault St. Marie, and the lake fleet that has wintered in the east surges forward into Lake Superior. Often they find hard going. Terrific storms send them to shelter behind Whitefish Point. Sudden drops in temperature cement the float ice

together, and the fleet is frozen in. An early April day in 1928 saw twenty-nine big lake freighters fast in the ice off the entrance to Duluth harbor.

Years ago, the "Western Reserve," the first of the big-tonnage ore carriers, left Duluth late in November with a full cargo. A few hours after she cleared, a northeaster howled down over the lake. No trace of the ship was ever found, except one lone life preserver washed up on the south shore. Lake sailors believe that she broke in two in the big seas and plunged to the bottom before the crew could take to the boats.

Since then there scarcely has been a single year without its fall or spring tragedy. The upper lakes are just naturally cold and stormy in the late fall and early spring. A variety of circumstances makes Massachusetts bay a fearful stretch of waters for cold-weather navigation. A portion of the Atlantic seaboard gets some measure of warmth from the Gulf Stream. By the time that warm current has reached the latitude of New England, however, it is far out to sea.

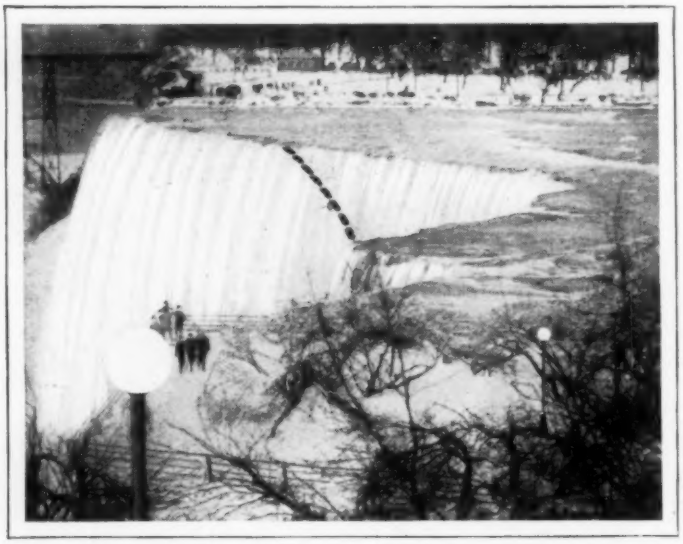
Chopping Ice from Pilothouse of Trawler; on a Trip across Massachusetts Bay, the Windows Were Covered with Ice Several Inches Thick

From whatever northerly point the wind blows, it sweeps down from districts noted for their low winter temperatures. A northwester howls from out the Hudson bay district, across the coldest section of Canada and New England. A northeaster usually originates in the vicinity of Greenland and whistles along the frigid waters of the icy Labrador current, that flows down from Baffin Land and loses but little of its frigidity until it encounters the Gulf Stream in the latitude of Long Island, too far south to moderate the intense cold of Massachusetts bay.

The ship making for Boston harbor across Massachusetts bay from the open ocean, finds not a fragment of shelter from either of these arctic winds. The fishing fleets from Georges banks have to take the blast on the nose as they run for harbor. Those from the Grand banks get the full sweep of the gale from the starboard beam, which is just as bad—if, indeed, not worse.

ELECTRIC SAND BOX FOR AUTO PREVENTS SKIDDING

Sand is released from a trap under the car to supply traction for the rear wheels on slippery surfaces. Pressing a button on the dashboard or steering wheel opens or shuts the trap.



Niagara Falls with V-Shaped Slice Gouged Out When Section of the Brink Gave Way; Dotted Line Shows Former Edge

CONTOUR OF NIAGARA CHANGED BY BREAK IN FALLS

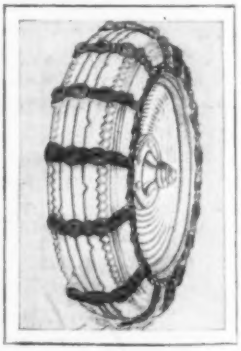
Niagara Falls, seemingly as changeless as the Pyramids, is feeling the ravages of time and nature. The greatest single change of all history in the contour of one of the natural wonders of the world occurred in January, when a gigantic section of the brink on the American side broke away and plunged into the turbulent river bed. A V-shaped slice was gouged out of the edge when a section of rock, 200 feet long and 150 feet deep, fell and piled halfway up the 162-foot precipice of the cataract. The most recent fall of rock comparable with that of January occurred on the Canadian side in 1850, when the Table rock section gave way. There also was a break in 1818, and three sections of the Horseshoe falls gave way in 1828. For about a quarter of a century, the curving brink of Horseshoe falls has been cut back more than two feet a year by erosion.

SECRET OF INDIAN SPIRIT TENT FOUND IN SET OF ROPES

Possible solution of the mystery of the shaking tent, a phenomenon produced by medicine men of the Chippewa tribe in calling up spirits to cure illness, has been offered by Miss Frances Densmore, an authority on Indian lore. Not long ago, she and her sister chanced to see the ceremony, a rite few medicine men can conduct and that fewer white persons have ever witnessed. The medicine man retired within his little tepee or pointed tent, was tied tightly with ropes and after awhile began to chant and beat on a drum. The tent shook violently although there was no wind. Miss Densmore visited the medicine man the next day and arranged to see the tepee. On the inside, she noticed hoops and ropes attached to the cloth covering in such a way that she believed the medicine man could use them to shake the tent after he had freed himself from his bonds and cause the covering to sway rhythmically.

VACUUM CUPS ON TIRE CHAINS PREVENT SKIDDING

Tire chains constructed on the vacuum-cup principle are being offered to provide another safety factor for the motorist in winter. Three or four steel vacuum cups are used for each cross chain. It was found that cups shaped like those made of rubber were unsatisfactory because they filled with ice and snow and did not work long. The steel cups are open at both ends, the vacuum being created between the road surface and the tire to keep the car from slipping on icy pavements. The cups taper slightly, being smaller where they come in contact with the road, and when the wheel turns, the snow and ice fall out as the cups come



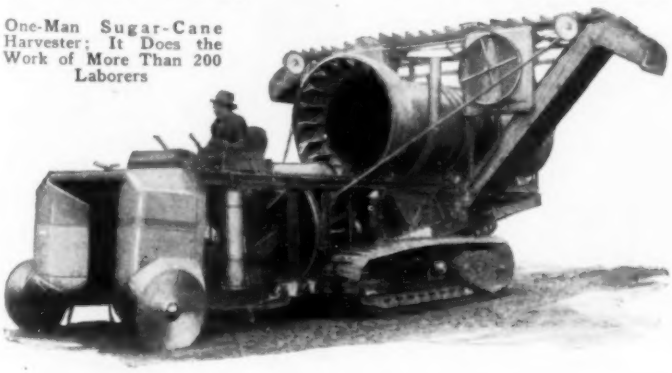
into an inverted position. Oval links connect the cups in such a way that road wear is greatly reduced.

WHAT ELECTRICITY COULD DO BUILDING PYRAMID

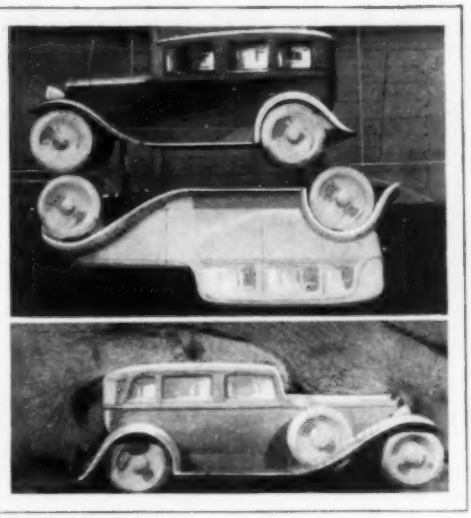
History records that the ancient Pharaohs used 100,000 slaves for twenty years to build the Great Pyramid of Egypt, but electric-power stations in Illinois alone supply in two weeks an amount of energy equivalent to that expended over two decades by 100,000 men. These stations have a capacity of 3,125,100 horsepower, each horsepower being equivalent to the work of five men. Operating only eight hours a day, the stations can produce in a year the equivalent of 45,626,460,000 man-power hours. If the slaves had worked eight hours a day for twenty years, they would have expended 5,840,000,000 man-power hours. If the Illinois power plants operated twenty-four hours a day, however, they could produce the equivalent of 136,879,380,000 man-power hours.

GIANT SUGAR-CANE HARVESTER DOES WORK OF MANY MEN

After fifteen years of experiment, two Australian inventors have made a sugar-cane harvester which will do the work of between 200 and 300 laborers. It weighs seventeen tons and travels on its own power on crawler tracks, one man operating all the controls. As the harvester goes down the rows, it cuts the stalks below the surface of the ground, saving the entire sugar content, carries them to rotating knives to be cut into four-inch lengths and then over an air blast to remove leaves and dirt.



One-Man Sugar-Cane Harvester; It Does the Work of More Than 200 Laborers



Model Autos Ready for Wind-Tunnel Test, and Plate That Shows Air Currents by Marks on Lampblack

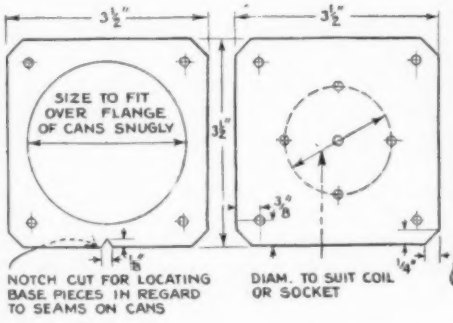
WIND-TUNNEL TEST FOR AUTO HELPS IMPROVE DESIGN

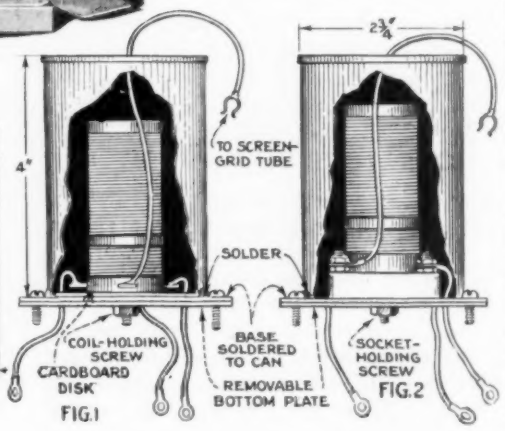
Wind-tunnel tests, similar to those given aircraft, are being applied to automobiles in order to show the wind resistance and other factors of various designs. Small models of the cars are suspended inside the tunnel, the results being obtained by accurate gauges that register the pressure and by an interesting "map" arrangement that shows the course of the air currents. A plate of aluminum is attached to the model at the longitudinal center line. It is previously coated with a mixture of lampblack and kerosene. As the wind blows along, the kerosene scours channels in the black, indicating the direction of the air flow around the model and the presence of eddies or partial vacuums that affect the performance of the car. Important data have been obtained from these tests, as, for instance, that careful streamlining saves as much as fifteen per cent in fuel consumption at top speed. The reduced power requirement makes it possible to gear the axle higher and turn the engine a smaller number of revolutions per mile of travel.

IT'S EASY TO MAKE YOUR OWN SHIELDS FOR COILS

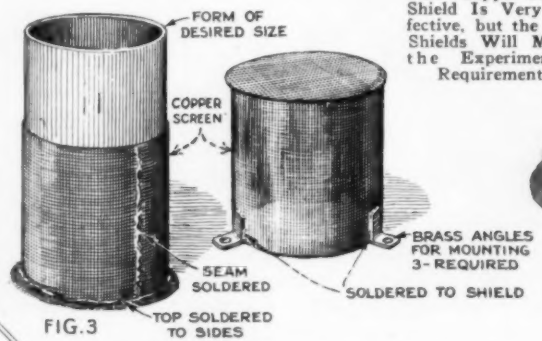
Three Coffee Cans Are Cut Up and Flattened Out to Provide the Base Material for the Can-Type Coil Shields; an Equal Number of Base Pieces Are Then Cut from the Templates Below; Soup or Baking Powder Cans Form the Shields

Fig. 1 Shows Coil Mounted Directly on Movable Base Plate, and Fig. 2 a Socket for Using Plug-In Coils; Can Size Depends on Coil Diameter, Keeping Proportions Shown





The Photos and Diagrams Show the Construction and Assembly Details Clearly; the Base Templates Provide Uniform Mounting Holes Making the Shields Interchangeable; Fig. 3 Shows a Coil Shield Made of Copper Screen Which Is Formed around a Wooden Block or Cardboard Tube of Desired Size. The Copper-Screen Shield Is Very Effective, but the Can Shields Will Meet the Experimenters Requirements



Two-Volt Tubes Used in Simple Auto Set

by J·O·Barnes

THIS homemade auto receiver fits into any car and provides ample volume. It has been carefully designed and thoroughly tested in several makes of cars, and will work on practically any type of car antenna. Those interested in building an inexpensive and efficient set for this purpose will find it entirely satisfactory.

There are several outsanding features that make this set quite different from the usual auto receiver. The new two-volt low-current tubes have two distinct advantages: First, it is not necessary to use the car battery to light the tubes; this does away with excessive battery drain; second, less filtering and spark-plug suppressing is required to eliminate ignition disturbances, making installation considerably easier and less expensive.

The circuit is extremely easy to build, and it has proved to be very sensitive and selective, two very desirable features. All parts are as light and compact as possible, and have been arranged for the short and direct connections quite necessary in a receiver of this kind.

Four ordinary No. 6 dry cells, connected in series-parallel, are used to light the filaments of the tubes. From 200 to 300 hours of operation may be expected from these A-batteries which can be renewed at a very low cost. The cells supply 3 volts, which are reduced by the two 1½-ohm fixed resistors, R_1 and R_2, to 2 volts, and the correct current supply for the tubes. The cells may be placed under the car seat or racked at a convenient point under the dash. Three 45-volt B-batteries and a 22½-volt C-battery are also required; these are placed in an ordinary battery box, either under the car, on the running board or under the seat. A multiplug cable is used to connect the batteries to the set; this is plugged into the stationary terminal unit, mounted in the set, and indicated in the photo on page 651. The schematic circuit diagram shows the leads running to this unit numbered from 1 to 5. The simplified wiring diagram, battery hookup and details of the metal cabinet, together with instructions for making the installation in the car, will be given in a concluding article in the May issue. A complete list of the materials is available, however, for those who wish to start construction immediately.

As shown in the schematic diagram, the circuit consists of two stages of screen-grid amplification, screen-grid detector, and two audio stages. The first audio stage is resistance-coupled and the second transformer-coupled. This arrangement is most satisfactory when using a screen-grid detector, and the resistance-coupled stage saves the weight of one audio transformer. The three small 55-mmfd. trimming condensers, C_7, C_8 and C_9, are used to line up the .00035-mfd. ganged tuning condensers after the set has been installed in the car. This fine tuning adjustment is made with a wooden spudger, or ordinary screwdriver, through holes in the side of the metal

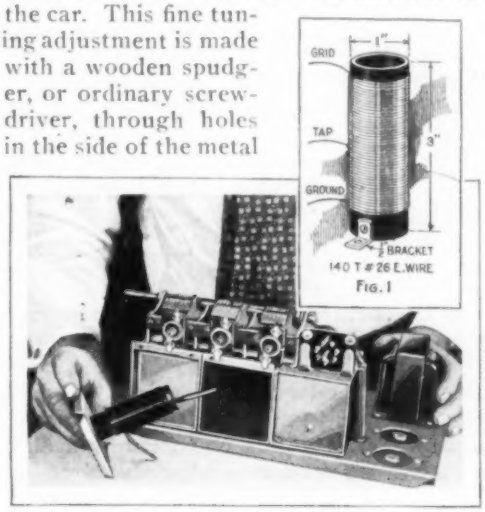


FIG. 1

cabinet and, when once made, requires no further attention. The trimming condensers are clearly shown on the side of the ganged condenser in the photographs on the preceding page.

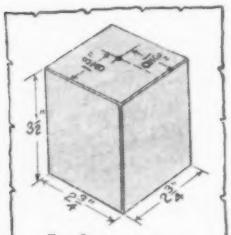


FIG. 3 COIL SHIELDS

The homemade coils are hand-wound on bakelite tubing as shown in Fig. 1 and are indicated in the circuit diagram as L_1, L_2 and L_3. All coils should have the same number of turns and be as nearly alike as possible, with no irregularities in winding or wire. The antenna coil L_1 is tapped at the 25th turn and coils L_2 and L_3 at the 20th turn. These leads are run down through the coil shields and metal base L_1 to the antenna post, and L_2 and L_3 to the .002-mfd. fixed condensers C_8 and C_{10}. The top lead of each coil is run through a hole in top of the coil-shield can and goes to the control-grid cap and the tuning-condenser stator of each r.f. stage. The bottom terminal of each coil is soldered to a lug placed under the small angle bracket, used to mount the coil on the metal coil-shield base. This grounds each coil on the metal chassis, which is the common negative-A and ground side of the set.

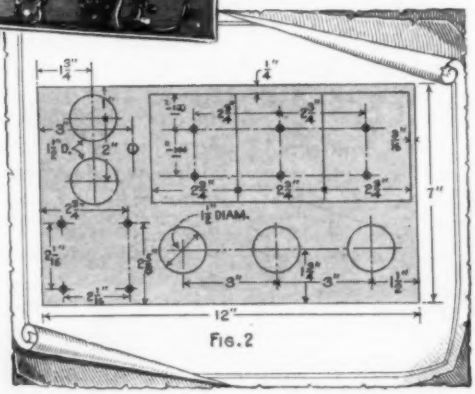


FIG. 2

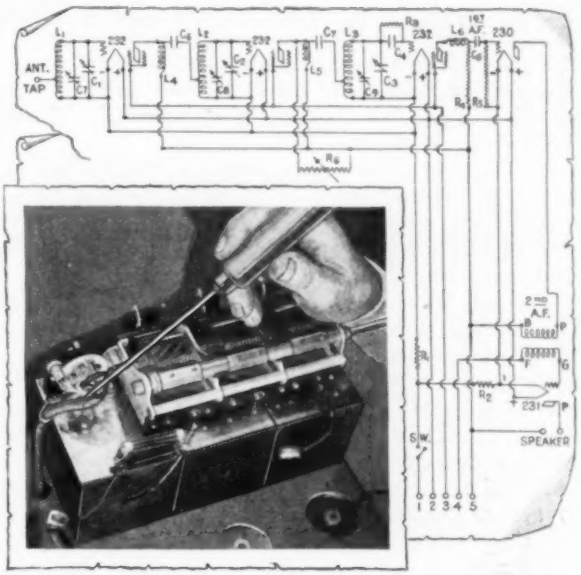
The metal base detailed in Fig. 2, and the coil-shield cans, Fig. 3, are made of 16-oz. copper sheet and may be burnished and lacquered if desired. The base should be cut ½ in. larger all around, clipped at the corners and bent down to provide room for the small fixed condensers, resistors and chokes underneath, as shown in the photo on this page. The coil-shield bases are also cut ¼ in. larger and turned down to fit snugly, as will be noted in the lower right-hand photo on page 649.

The metal base should be laid out carefully, as shown in Fig. 2, and the holes drilled for mounting the various parts. The five holes for the subpanel mounting sockets may be cut with an adjustable flycutter, and two extra mounting holes are required for the short 6-32 machine screws used to fasten the sockets to the base. These holes are easily located by using a socket as a template. A No. 27 drill is used for all the small holes in the base. The holes for mounting the coil-shield cans are shown within the space ruled off at the upper right. These cans are mounted with the open ends toward the edge of the base and are screwed down to the base by means of two short machine screws through the side of each can.

The coil-shield cans provide a mounting base for the ganged tuning condenser, multi-terminal plug and the grid condenser and gridleak. This .00025-mfd. grid condenser, C_4, and the 3-meg. gridleak, R_3, which is connected across it, are insulated from the metal can. One side of this unit is connected to the top end of the coil L_3 and the stator of the tuning condenser C_3. A flexible clip-lead connected to the other side goes to the control-grid cap on the detector tube.

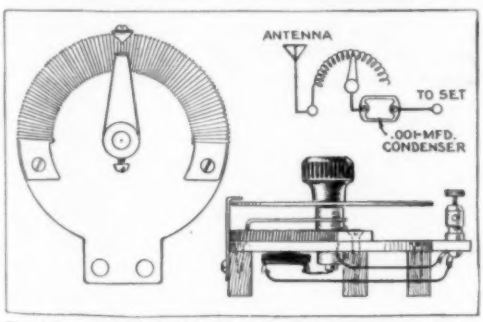
The base is now reversed, and the vari-

ous fixed condensers and resistors, as well as the three small flat-type 60-millihenry choke coils L_4, L_5 and L_6, mounted. The resistance-coupled audio stage consists of the resistor R_4 of 250,000 ohms, R_5 of 500,000 ohms, and the .1-mfd. blocking condenser C_5. The A-battery switch is combined with the 10,000-ohm volume-control unit R_6, and the leads to this unit are made quite long, as shown in the photo on page 650, so that the unit may be either mounted on the front of the metal cabinet or extended up to the auto instrument board, if desired. The audio transformer in the second stage may be any small type having a ratio of about 3½ to 1. When wiring the set, care should be taken that all leads passing through the metal panel or shields are well insulated. Ordinary flexible rubber-covered hookup wire may be used for the circuit, but the long leads running up to switch and volume-control unit mounted on the instrument board, should be made with heavier insulated wire. For the leads from the coils that are taken out through the cans, a good grade of spaghetti tubing should be used. A flexible rubber grommet is used in the metal base where the short cabled leads are taken up to the multi-plug terminal unit mounted on top of the coil-shield cans.



Making an Antenna Regulator

An inductance and capacity unit that is connected in series with the outside antenna aids materially in separating stations at the lower end of the dial. The illustration shows a unit of this kind. The coil and mounting form is made of ⅛-in. bakelite cut to the shape shown; the base is 3½ in. in diameter with a slight extension for the binding posts; holes are drilled, one in the center to pass a ¼-in. shaft, two in the extension, and three for screws to hold the coil form in position. The coil form is ⅝ in. wide and is wound with No. 28 s.c.c wire, the exact number of turns being immaterial. The wire is shellacked to the form, and, when dry, the insulation is scraped from the turns in the path to be followed by the contact arm. The shaft is a piece of ¼-in. threaded brass rod and the contact arm is obtained from an old rheostat. A celluloid or aluminum dial of the flat type and a pointer, cut from sheet brass and mounted on one of the three short wooden feet that support the unit, complete the assembly. One end of the coil is fastened to one of the binding posts and the other end of the coil left dead. The small fixed condenser is wired in series with the contact arm and the remaining binding post.—E. Laschi, Union City, N. J.

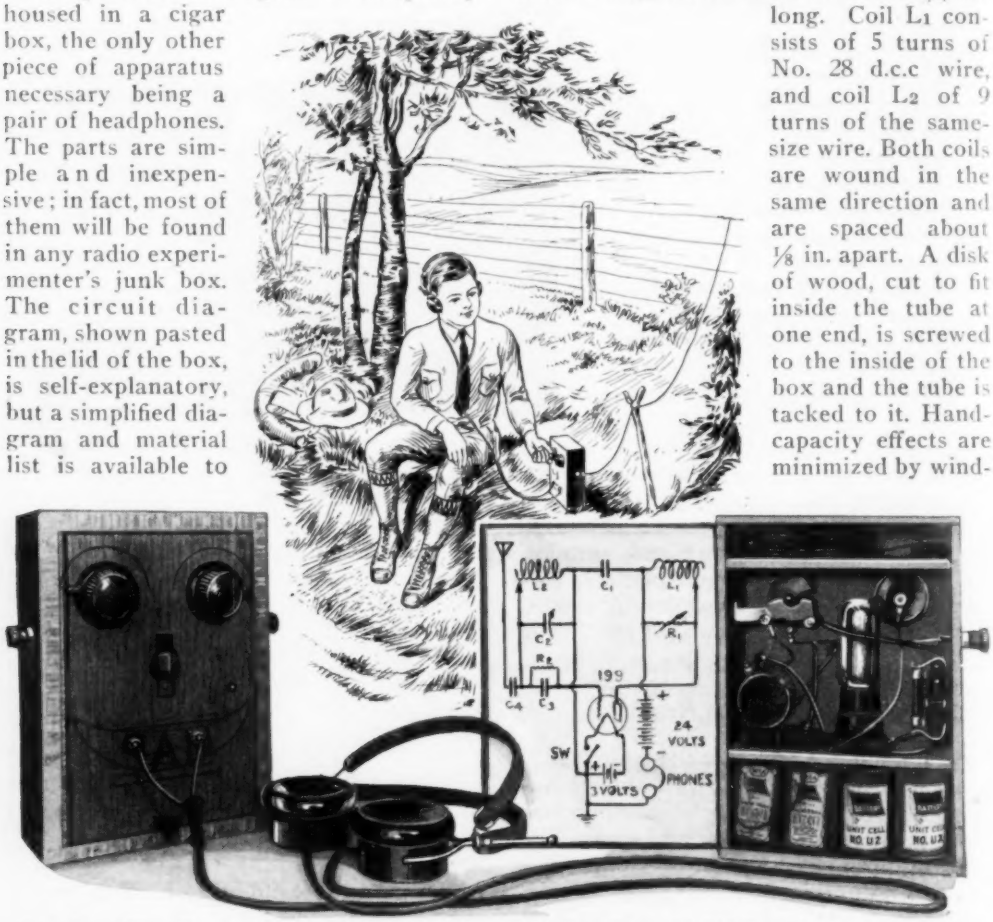


Top View of Unit; Simplified Circuit Diagram, and Sectional View of Assembly

For further information on any radio construction article write to the radio department; this service is free.

BUILDING A POCKET-SIZE SHORT-WAVE RECEIVER

Particularly suited for the hiker, the pocket-size short-wave receiver illustrated in the photos and diagram is completely housed in a cigar box, the only other piece of apparatus necessary being a pair of headphones. The parts are simple and inexpensive; in fact, most of them will be found in any radio experimenter's junk box. The circuit diagram, shown pasted in the lid of the box, is self-explanatory, but a simplified diagram and material list is available to all who wish them. The two flashlight cells, shown in the rear view at the right, are small round, 1½-volt unicells connected in series to supply 3 volts for the 199-tube filament. At the left, are eight small 3-volt flashlight batteries connected in series to furnish 24 volts of B-battery for the plate of the tube. The center compartment contains the tube, grid condenser C_3 and gridleak R_2, and the variable resistance R_1, of 500,000 ohms for controlling regeneration. The tuning condenser C_2, consisting of a five-plate midget type, is mounted at the left, and directly below are the coils L_1 and L_2, which are wound on a piece of cardboard tubing taken from an old flashlight battery. The tube is 1 5/16 in. in diameter and 2¼ in. long. Coil L_1 consists of 5 turns of No. 28 d.c.c wire, and coil L_2 of 9 turns of the same-size wire. Both coils are wound in the same direction and are spaced about ⅛ in. apart. A disk of wood, cut to fit inside the tube at one end, is screwed to the inside of the box and the tube is tacked to it. Hand-capacity effects are minimized by winding the coils so that the grid end of coil L_2 is near the rear of the receiver, as far away from the hands of the operator as possible. The receiver is designed to cover the amateur 20-meter band with a generous margin on each side. The blocking condenser C_1 is a .002-mfd. fixed type and is mounted directly below the coils. The grid condenser C_3 is .00004 mfd., and the gridleak is an 8-meg. cartridge type. Condenser C_4 is in series with the antenna and consists of two pieces of aluminum, ¾-in. square, spaced ⅛ in. apart. The filament switch and binding posts for the phones are located in the posi-

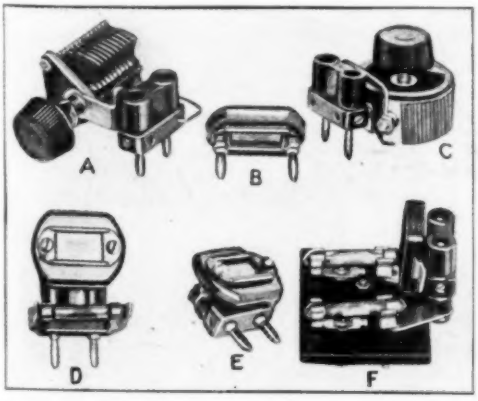


Left, Front View Showing Switch and Control Knobs; Right, Rear View with Lid Opened, Showing Arrangement of the Various Parts and Wiring Diagram

tions noted in the photo at the left. The posts for the antenna and ground are placed on either side of the box at convenient locations. The upper compartment holds a small logbook, pad, pencil and a 100-ft. coil of No. 30 enameled wire for an antenna. To operate the receiver, connect a small glass insulator to the end of the antenna wire, uncoil the wire and fasten the insulator to a limb of a near-by tree, or, if preferred, shorter wire can be connected to a wire-fence antenna as shown in the sketch. The ground connection may be made with a metal rod driven into damp ground, to which a flexible lead is soldered and connected to the ground binding post. This receiver has not a great deal of volume, but as there is very little interference in the open country this is not of much consequence. It actually works and even has DX-possibilities.—L. F. Leuck, Lincoln, Nebr.

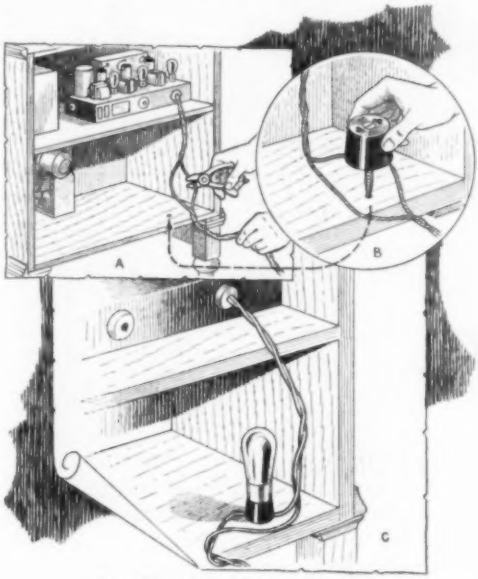
Plug and Jack Combinations Are Aids to the Experimenter

The radio experimenter's "breadboard" layout may be made into a flexible and economical arrangement if it is provided with the necessary standard-spaced jacks for plugging in various circuits. This is now made possible by several devices, some of which are shown in the illustration, and others equipped with mounting bases that may be quickly plugged in and out of breadboards designed for them. The midget condenser at A, the rheostat at C, and the gridleak and condenser at D, are a few simple applications of the idea. Single plugs are used for the fixed condenser B, or the twin unit may be used, as shown at E. A complete resistance-coupled stage ready for plugging in is shown at F.



Handy Plug and Jack Combinations Which Are Highly Useful to the Experimenter

Tube Controls Line Voltage



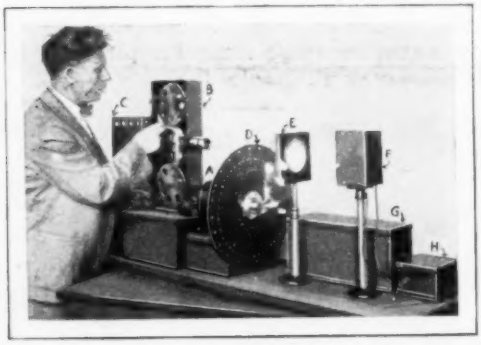
Installing Line-Voltage Regulator

Power companies cannot maintain a definite 110-volt current at the light socket. Therefore, as a means of compensating for fluctuating voltages, to protect the tubes in a.c. sets and enable the owners to get the best results, a self-adjusting line-control tube is available. It is connected in series with one side of the a.c. supply line, between the set and the wall socket, and installed in three simple steps, as illustrated at A, B and C. There is a special socket for the tube, but if this is not available, a UX-tube socket may be used in its stead.

Testing Power Units

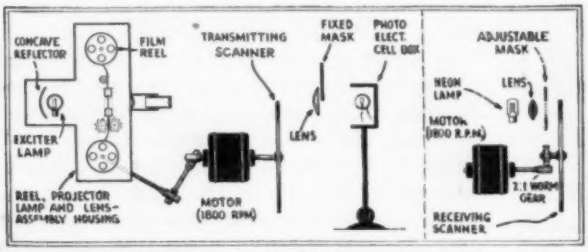
An open or short circuit in the output of a power unit employing either a 280 or 281-tube will cause a zero reading at the terminal board. If the tube burns normally, look for an open circuit in one of the resistance units in the voltage divider or wiring. If the tube burns with a blue glow, it is very likely caused by a short circuit in filter condensers or wiring.

Television Projector for Amateurs



Front View of the Transmitting Unit, Showing Operator Inserting Film

A simple transmitter now enables amateurs to project television images over a wire from room to room. With this equipment, and standard-size (35 millimeter) silhouette film, any experimenter may work with wired television without the handicap of poor reception. The apparatus consists of a motion-picture projector combined with the usual motor-driven scanning disk, photo-electric cell and television-frequency amplifier. A simplified receiver, consisting of a similar synchronous motor with scanning disk and neon tube, completes the installation. The motors, operated on the same a.c. supply, keep both disks in perfect step. No license is required for this kind of operation, but licensed amateurs may use the modulated energy output of the transmitter to regulate the carrier wave of their short-wave transmitter in the usual manner. In the photo, A is the reduction gear, which is driven from rear end of motor shaft; B, the reel housing; C, the exciter lamp; D, the scanning disk; E, the lens; F, the photo-electric cell; G, the frequency amplifier, and H, the phase reverser. The purpose of the latter is to enable either positives (black on white background) or negatives (white on black background) to be televised.



Arrangement of the Apparatus; the Transmitter Is Shown at the Left and the Receiver at the Right

Red Pencil Prevents Wiring Errors

When wiring a new circuit it is a good idea to have a red pencil handy and draw a line over each connection in the blueprint as you complete the corresponding lead in the set. In this way a constant check may be kept on the amount of work completed and no connections will be overlooked. By adopting this scheme needless checking is avoided as well as loss through damage to tubes and parts.

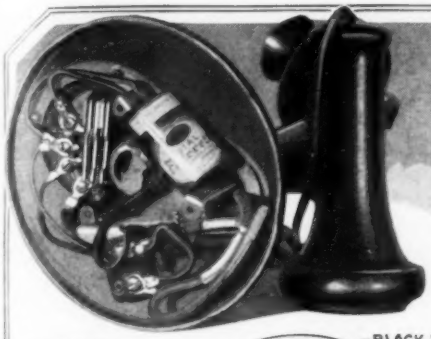
Phonograph Is Combined with Midget Set

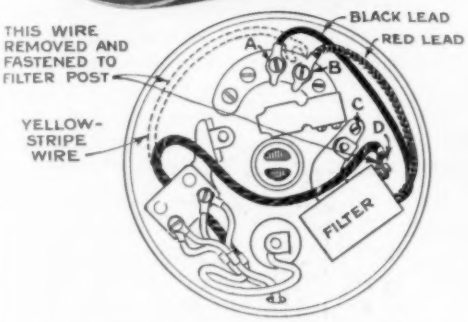
Phonograph entertainment as well as radio programs may now be enjoyed by midget-set fans, a compact little receiver recently placed on the market combining both features. It consists of a 6-tube a.c. screen-grid circuit, a small dynamic speaker and a phonograph motor with automatic stop and pick-up arm.

Removing Film from Antenna Insulators

Within a few months' time antenna insulators will gather a film of soot that will lower their efficiency. This is true of any type of insulator, and the lowered insulating value is quickly noticed in amateur transmitting installations. The effect in standard broadcast receivers is noted by the increasing difficulty in tuning in distant stations. It is a good plan to lower the antenna at least once every six months and wash the insulators with warm water or carbon tetrachloride, after which they should be polished with a soft rag. At this time, the antenna should be inspected for bad connections, and the guy wires and lead-in checked.

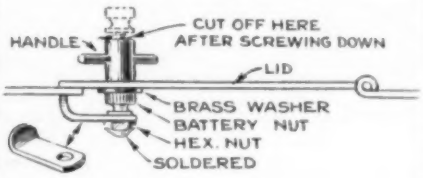
SIMPLIFIED ANSWERS TO YOUR RADIO PROBLEMS

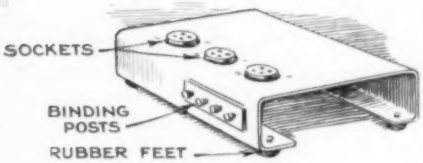




Above, Filter Installed in Base of Automatic Dial Telephone Removes One Source of Radio Interference; Right, Screwdriver with Insulated Handle Used to Discharge Condensers before Making Power-Unit Adjustments, as Such Condensers Hold a Charge for Some Time After Line Switch Is Thrown

Below, Catch for Lid of Metal Shield Box Made from Old Binding Post and Switch Lever; Left, Strips of Old Inner Tube Tacked Flat behind Speaker Baffle Improve Tone

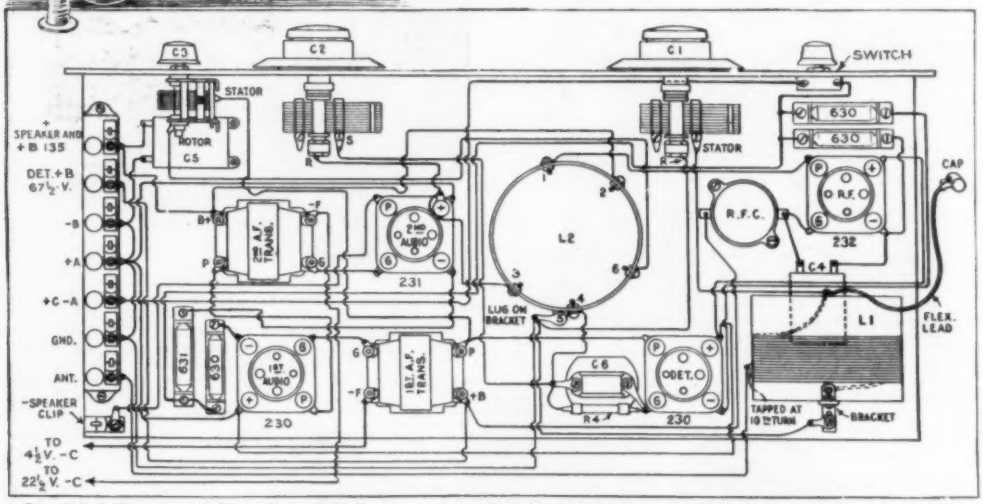




Above, Simple Metal Base for Homemade Amplifier Units Easily Constructed from 3/32-In. Aluminum Sheet; Left, These Sturdy New 2-Volt Tubes and the Long-Life Air-Cell A-Battery Designed for Them, Now Bring to Homes Not Served with Power Lines, the Same-Quality Reception and Ease of Operation as That Enjoyed by Users of Power Sets

FOUR-TUBE DX-RECEIVER USES TWO-VOLT TUBES

The diagram shows the necessary changes in the circuit of the Four-Tube DX-Receiver, described in the November issue, to enable those who built the set to change over to the new low-current-consumption tubes, designed for battery operation at 2 volts. These tubes give four times the length of service on a single charge of the 6-volt storage battery. This is made possible by new type-630 and 631 amperites, which reduce the voltage and limit the current. It will be noted that a small battery switch has been substituted for the 25-ohm rheostat; that 22½ volts negative C-bias is put on the grid of the second audio tube, and that the 90-volt tap has been reduced to 67½ volts. The amperites are easily mounted and connected in the positions shown, and no other changes are necessary unless the experimenter wishes to shift the tap on the antenna coil for better selectivity. This will be best determined by trial. Those who prefer to operate the set on a single 2-volt cell of the storage battery or with one of the new air-cell batteries, specially designed for these tubes, may do so by shorting out the amperites. This receiver may also be operated with two No. 6 dry cells connected in series, or four dry cells connected in series-parallel, as desired. To do this, it will be necessary to reduce the 3-volt output to 2 volts and limit the current, as before. In this case a 1½-ohm fixed resistor is inserted in the A-negative lead to the filaments of two audio tubes, which are connected in parallel. The r.f. and detector-tube filaments are then also connected in parallel and a 1-ohm fixed resistor is inserted in the A-negative lead to control these tubes.



Simplified Diagram of Four-Tube DX-Receiver, Described in the November, 1930, Magazine, Showing Circuit Altered for Two-Volt Tubes

An Aid in Soldering Small Parts

When two small parts are to be soldered together, it frequently happens that, while heating one part, a previously soldered joint becomes sufficiently heated to come loose. Overheating may be controlled by using a thin sheet of copper upon which to lay the work. Sheet aluminum is also suitable for the purpose. A sheet of metal, about 1 ft. square, should be employed, and a hole is drilled in one corner for hanging the sheet on a nail when it is not in use.

Building A Midget A.C. Receiver — *Part 2*

THE ASSEMBLY and wiring of the midget set, described in Part 1, being completed, we will now take up the construction of a suitable cabinet and the installation of the chassis. The design, which is a modified modernistic type, is well suited to the proportions of the receiver, and will harmonize well with the furnishings of most homes.

With the exception of a few pieces, the entire cabinet is made of plywood panels. Most of the edges are painted with an opaque color that completely hides the core lines, and the remainder are at the corners, where they are neatly and completely housed by cutting back all the stock except the thin outside veneer which, when glued in place, covers the edge of the other piece.

All the general dimensions are given in Fig. 1. The following pieces are all cut from one ⅜ by 32 by 48-in. panel: Two, 10¾ by 22 in., for the sides; one, 10¾ by 17½ in., for top; two for top overlay, one 10¼ by 13½ in., and the other 9⅞ by 11½ in., and for side overlay, two 8 by 19 in., and two 6½ by 17¾ in. Another panel, ¼ by 24 by 42 in., supplies the material for the following pieces: One, 17 9/16 by 22½ in., for front panel, allowing for joints; two, 2¾ by 18¾ in., for overlay wings; one, 2½ by 14½ in., for bottom overlay triangle, and one, 1 by 8½ in., for top overlay triangle. Both of these panels should be walnut on one side. In addition, a piece of so-called "drawer-bottom" panel, ¼ by 24 by 36 in., will be needed for the backing and speaker support. The back piece is 17⅛ by 21½ in., and the speaker-supporting piece 10 by 15¾ in. Any ½-in. soft wood may be used for the bottom and cleats, but ½-in. solid walnut is required for base molding.

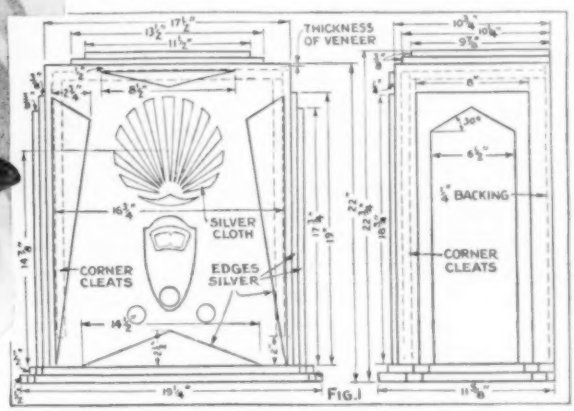
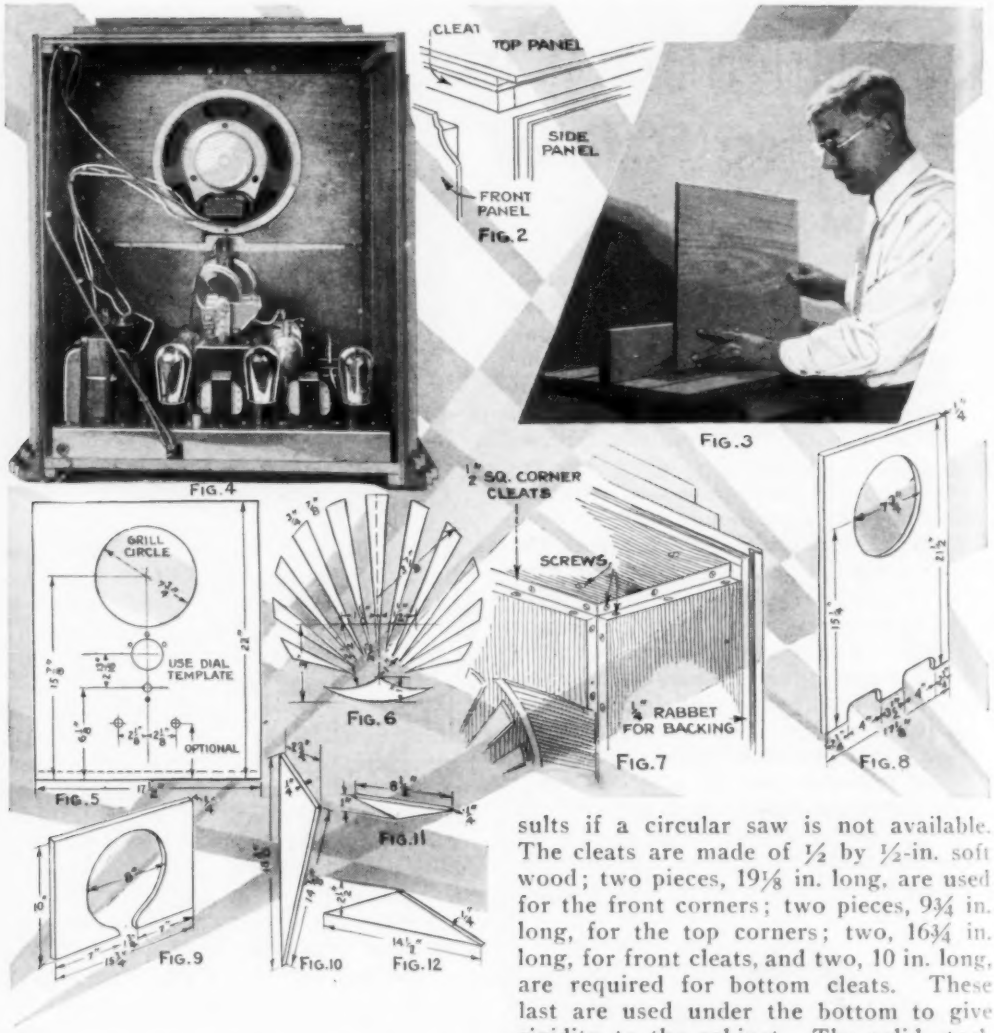


FIG. 1



After the side and top panels have been cut to size, a joint should be run on each end of the top piece as shown in Fig. 2. This is done by cutting away all of the stock, except the outside veneer, sufficiently to house the sidepieces. Fig. 3 shows a step in making these cuts on a circular saw. A 4-in. board is screwed to the fence of the saw guide to keep the work perfectly true. When performing the first operation, the panel is held flat on the table with the edge against the fence; the second step, shown in the photo, is obvious, but both require a careful set-up and test on scraps of similar veneer before cutting the piece to be used. A chisel or hacksaw will accomplish the same results if a circular saw is not available. The cleats are made of ½ by ½-in. soft wood; two pieces, 19⅛ in. long, are used for the front corners; two pieces, 9¾ in. long, for the top corners; two, 16¾ in. long, for front cleats, and two, 10 in. long, are required for bottom cleats. These last are used under the bottom to give rigidity to the cabinet. The solid stock piece for the bottom is ½ by 10¼ by 16¾ inches.

The sides, top and bottom should be assembled first. By placing the cleats a trifle back from the edge, the screws may be made to draw the joints snugly together without the use of bar clamps. Screws may also be driven from the outside of the cabinet, through the panels, to fasten the bottom into place, as the heads will be covered by the base molding. If the back panel is cut to size and tacked into the ¼-in. rabbet, which has previously been cut in the sides and top, it will hold the frame square while the glue is setting. This rabbet is clearly shown in the rear-view photo Fig. 4.

Fig. 5 shows the layout of the front panel. The controls may be mounted on the chassis or the leads extended for mounting directly on the front panel. The pattern of the grill is given in Fig. 6, and should be laid out carefully on a piece of heavy paper. A jig or scrollsaw is used to make the cut-outs. Three edges of the front panel are cut away as shown in Fig. 2 to form the joints. The panel should be made a trifle larger than the measurements given so that the veneer will extend beyond the edges and can be sanded down to a nice square corner after the glue is dry. Screws through the cleats are used as before to draw the joints tight. Fig. 7 is a view of the cabinet from the back, and shows the arrangement of cleats by which the panels are joined and reinforced.

A hole is cut through the back and slots are left at the bottom, as shown in Fig. 8. Since the front panel is only ¼ in. thick, a second piece, shown in Fig. 9, which may be called the speaker support, is used. This is screwed and glued to the panel after the grill has been backed with cloth.

The overlay panels are fastened to each other and to the cabinet with screws driven from the inside. This method of fastening is used rather than gluing because it is less difficult to finish and paint the edges of the pieces when they can be separated. Figs. 10, 11 and 12 show the sides of the ornamental overlays on the front panel. Care must be taken on the sharp corners to avoid tearing the core out from between the outer layers. Be sure that the screws are not so long that they come through the face of the stock.

The following pieces of solid-walnut base molding are required and allowance has been made for joints: Two pieces ½ by 1⅛ by 11 in., for upper side base; two, ½ by 1⅞ by 11 in., for lower side base; one, ½ by ⅜ by 18½ in., for upper front base, and one, ½ by ⅞ by 18½ in., for lower front base. These moldings are made in two parts, or layers, which are glued together, and then glued and screwed to the sides and front of the cabinet at the bottom. Figs. 13 and 14 show the method of laying out the steps, which may be cut with a hacksaw and chisel, or with a bandsaw as shown in Fig. 15. The corners of the molding are mitered, which will require careful fitting. Fig. 16 shows how the finished corner should look. The job is now ready for sanding and finishing.

FIG. 15

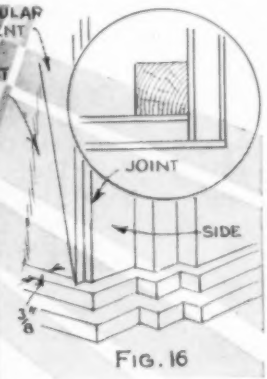


FIG. 16

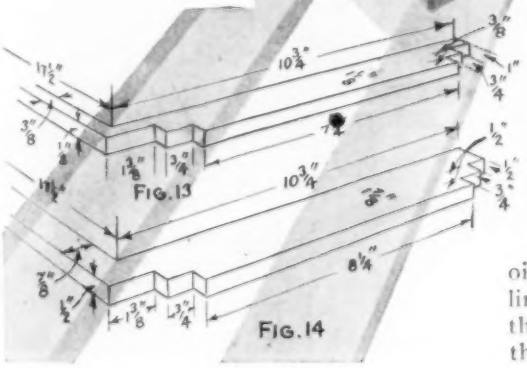


FIG. 13

FIG. 14

The finish consists of a coat of dark walnut wood-paste filler, which should be rubbed off when it loses its gloss, two coats of dark walnut oil stain, and five or more coats of boiled linseed oil. Fig. 17 shows the designer of the cabinet applying a coat of stain to the front panel. The oil should be ap-

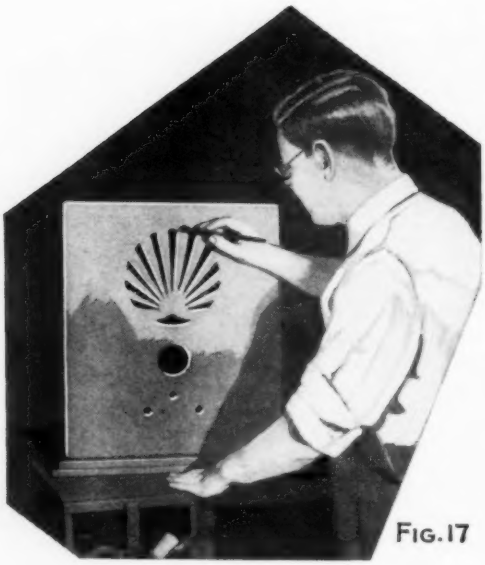


FIG. 17

plied and allowed to soak in for a few minutes, then rubbed vigorously. A second application may be given the cabinet immediately.

In order to cover the edges of the veneer and give life to the cabinet, all of the exposed veneered edges are painted with so-called "silver paint." The end grain, which is exposed on the base molding, should also be painted in this manner. A piece of silver cloth stretched behind the grill and covered with the speaker-support board completes the cabinet. Enlarged diagrams of receiver and cabinet construction details are available.

The receiver should be checked and balanced before the chassis is installed in the cabinet. The set-up for testing is shown in the lower photo on page 657. The leads to the dynamic speaker are left quite long, and the tuning dial is mounted temporarily on the condenser shaft. The chassis is placed near the cabinet, and the speaker is then mounted on the supporting board.

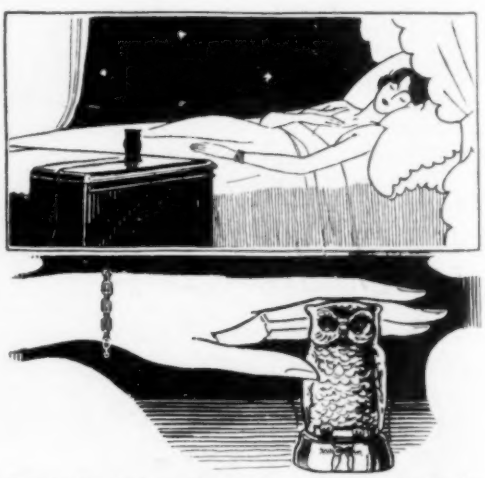
If the set is to be used in crowded localities near powerful broadcasting stations, it will be necessary to shield all three of the screen-grid tubes. It is also advisable to use trimming condensers across both of the ganged tuning condensers in the band-pass filter for maximum selectivity. Further tests have shown that better volume control may be obtained by substituting a 2,000-ohm variable resistor for the 10,000-ohm unit shown in the simplified diagram in Part 1. It is connected between the antenna post and chassis.

To balance the receiver, a distant station, or faint local, is tuned in and the trimmers adjusted with a wooden spudger until the signal is received with greatest volume and no stations overlap. In most cases it is not necessary to use a ground connection, and the length of antenna will differ in various locations, six or eight feet being about right near strong locals.

After completing the tests, the dial escutcheon is mounted on the front of the cabinet together with the volume-control unit and line switch. The chassis is then installed and the leads connected to the panel controls. Small blocks of wood or strips of packing cardboard are used between the chassis and the cabinet at each side to hold the set firmly. The back panel is then screwed in position, completing the installation.

Radio Owl Turns Off Set

An automatic switch, built into a bronze owl, shuts off a radio receiver or other electrical appliance at any desired time. The device is equipped with double leads for plugging into the electric outlet and for connection to the apparatus to be controlled. After the connections have been made, the operator pushes the owl's head down, which switches on the current, and sets the shut-off time by means of an indicator on the front.



The Radio Owl on Duty; Below, Putting the Device in Operation

AMATEUR MECHANICS

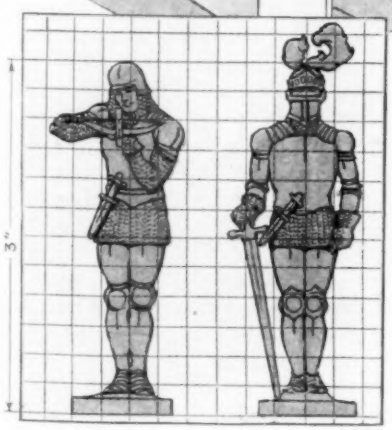
Indoor Target Practice with Crossbows

By J. V. HAZZARD

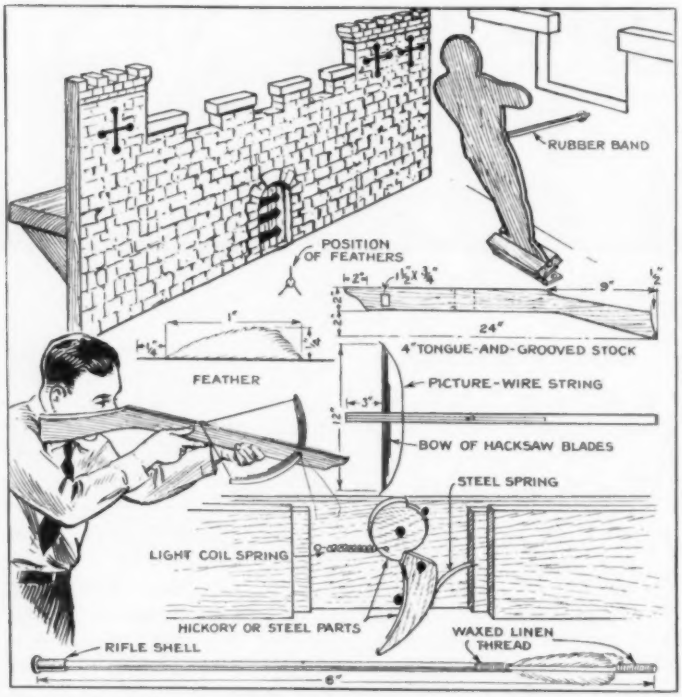
DRIVING short arrows at lightning speed and with pleasing accuracy up to a range of about 30 ft., homemade crossbows make the illustrated shooting gallery an interesting indoor diversion.

The stock of the weapon is cut from a ¾ by 4 by 24-in. piece of tongue-and-grooved pine, while the bow itself can be made of hacksaw blades, umbrella ribs or corset stays. If hacksaw blades are used, the bow will somewhat resemble an automobile spring, except that it should be wrapped closely with fine wire from end to end. The longest blades, of which there should be 3 or 4, are 12 in. long. Upon these are laid an equal number of shorter pieces of gradually diminishing size, the shortest one forming the back of the bow. With a 12-in. bow, the catch for the string should be set about 6 in. behind it, since

Short Arrows, Driven Accurately by Means of Homemade Crossbows, Make a Basement Shooting Gallery an Interesting Diversion



a longer draw would result in fracturing the bow. Hickory, maple or steel may be used for the trigger and catch, and the width of the mortise to receive this mechanism must be determined accordingly. A ¼-in. mortise is satisfactory for wood, and a 3/16-in. mortise if a metal catch and trigger are used. It is a good plan to set up the trigger mechanism on the side of the stock, using shingle nails as pivots, and making all necessary adjustments before attempting to set it permanently in the mortise, as the mechanism must work



Details of the Castle, the Bow, the Gun Stock with the String-Releasing Mechanism and the Darts

smoothly for good results. When finally adjusted, holes for the pivots are drilled where nails were driven in temporarily, and unused holes are plugged with plastic wood. To keep the trigger in place, a short steel spring is used, one end being pushed into a cut made at the rear end of the mortise and the other bearing against the trigger as shown. If desired, a staple may be driven in the front end of the mortise, and the back side of the trigger notched so that a rubber band can be used to keep it in place. A small pin in front of the trigger serves as a stop. The catch has two notches as shown, and is returned to the correct position, after making a shot, by means of a small coil spring or rubber band. After the trigger is pulled, which releases the catch, it is held back with the finger until the catch returns to its original position.

Picture wire makes an ideal string for the bow. It should be long enough to reach from end to end of the bow without bending it, but should not be loose as shown in the illustration. The bow is bent only when the string is hooked over the catch. Darts may be made from a variety of materials, although rattan and cattail stems are well suited to the purpose. They should be 6 in. long, tipped with 22-gauge rifle shells of the long type, and are feathered at the other end as indicated. One feather drops into the groove along which the dart is shot, while the other two ride over the edges.

For an indoor target it is hard to improve on a castle, which can be made of 1-in. wood in a suitable box. The box should be large enough to catch wild shots, and deep enough to permit falling men to clear the back if they are hinged to the parapet, or shelf, on which they stand. Both box and castle should be painted to represent stone masonry. The men-at-arms and the knights are cut from plywood, as shown in the drawing, in which each square represents ¼-in. After painting, they are mounted on small blocks of wood. If desired, these may be hinged to the parapet and a rubber band provided to allow them to be knocked down, but pulling them back to standing position.

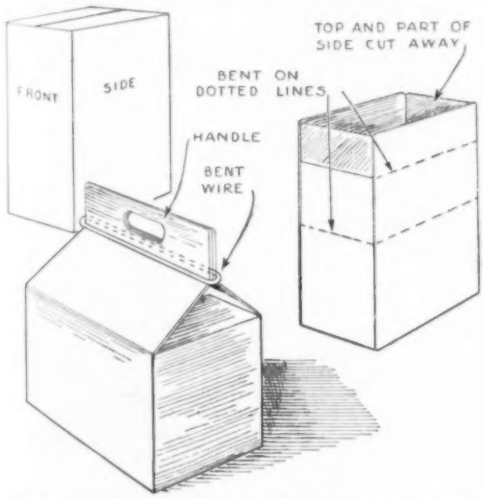
Another variation is to provide a string to pull the figures up, the string extending to the line from which the players shoot. One man-at-arms stands in each embrasure and scores 25 when hit, while the knights are stationed at the far edges of the parapet immediately behind one of the battlements and, being harder to hit, count 75. The castle should be placed about 4 ft. above the floor. At a 12-ft. range, the shooting will be as accurate as if the men were of full size on a wall 40 ft. high and 40 to 50 yd. away. The embrasures measure 1½ in. across at the bottom and are separated 1⅝ in. from each other at the top. The floor of the parapet is arranged so that the bowmen reach to the top of the embrasures.

How to Tell Color of Unlabeled Flower Bulbs

Sometimes, after saving flower bulbs, they are mislabeled or the label is lost, causing considerable loss to the grower or dealer. In varieties such as the ordinary garden crocus, where color is the first requisite, the loss of labels can be rectified by a very simple method. Take a bulb that shows a sprout, cut it open with a sharp knife or razor blade, cutting through the shoot. Inside of the shoot you will find miniature flowers of the color that they will show when in blossom. Although the colors will be of a light shade they can nevertheless be identified.—J. Herbert Ferris, Elberta, Mich.

Kit Made from Paper Carton

To make a serviceable carrying bag, cut off the top of a cardboard carton and part of the sides as indicated by the shaded portion of the right-hand detail. Split the edges down to the second dotted line, score the board on both lines and bend the ends inward until the container takes the shape shown at the left. Slip a length of doubled wire over the top ends and cut a handhole through them. The handle portion can be strengthened by gluing a strip of wood along each edge, on the outside. A few coats of shellac or varnish on the outside will make the box last much longer than it would if not protected.—L. T. Stroever, Piedmont, Calif.



Serviceable Carrying Bag for Groceries or Tools Can Be Made from a Cardboard Carton

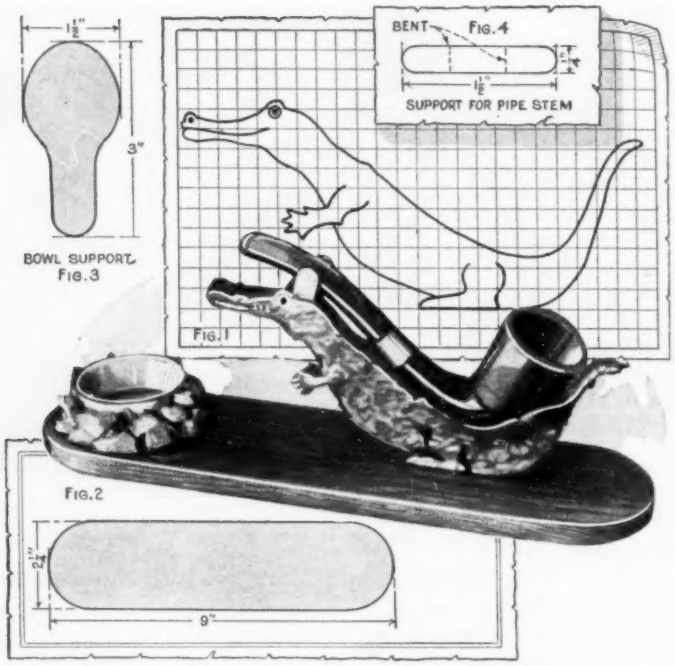
Newspapers Make Cheap and Effective Masking for Use when Spray-Painting Automobiles

Masking Auto Windows with Newspapers

When spray-painting a car, no better and cheaper masking for the windows can be found than newspaper. To apply it, lower the window slightly, insert one edge and then close the window to hold the paper in place. The three other edges are held with strips of tin, inserted between the window channel and the metal frame. These strips also prevent the paint from getting on the window channel, and can be used repeatedly, the coating of paint on them being removed occasionally when it gets too thick.—F. J. McGinnis, Cleveland, Ohio.

Bouquet of Christmas Lights As Centerpiece

Crepe-paper flowers and a Christmas-tree lighting outfit can be combined to form an attractive electric bouquet as a centerpiece for the table. The paper flowers are placed around the socket of each light, and the cord wrapped with green crepe paper to give the appearance of a stem and leaves. A piece of wire can be used to make the stems stiff. Bulbs of a color corresponding to the flower in the center of which they are placed are screwed into the sockets, and the flowers bunched together and placed in a basket or vase. The bouquet often provides all the light needed for a dinner party.—Sterling D. Fox, St. Louis, Mo.



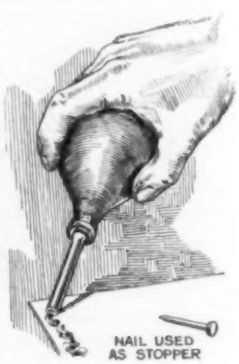
Besides Making an Attractive Ornament for Your Desk This Holder Keeps Your Pipe from Upsetting

An Alligator Pipe Holder

For pipes with curved stems a holder made to resemble a miniature alligator will not only make an attractive ornament but will also prevent ashes and tobacco from being spilled on the table. Both the alligator body and the base are cut from three-ply veneer, ⅜ in. thick. The dimensions for the base are given in Fig. 2, while Fig. 1, laid off in ¼-in. squares, outlines the alligator. It may be necessary, however, to modify the curve of the back to make it fit the pipe stem. The stem and bowl supports are cut from sheet copper or brass to the shapes and sizes given in Figs. 3 and 4. Hammer the bowl support to the proper shape, using a piece of soft wood having a suitable hollow. Small brads are used to attach the copper parts to the wood, and the alligator is fastened to the base with two woodscrews driven from the underside. Plastic paint or gesso, which can be obtained at almost any paint or art store, is then applied to the alligator body. Try to make this coating as realistic as possible in its resemblance to alligator hide. While the plastic paint is drying, the ash tray or match holder, as you prefer, is made of small pebbles cemented together with plastic paint. A very small pan is used for the tray. When finished, the base and the "mortar" may be enameled or lacquered. This should be allowed to dry before the alligator is painted. A yellow or brown is preferable, and the coat is allowed to dry until barely tacky, when statuary bronze is applied. When the paint has dried still more so that it will not come off when the bronze is rubbed with the fingers, some green bronze is applied and rubbed into the paint with a soft camel's-hair brush. The surplus is blown off and after 15 minutes, a clean, soft cloth is used to rub down the high spots, leaving the green in the depressions only. The dull bronze will remain on the sides of the depressions while the high spots will take a sheen. Afterward black lines, indicating legs, and the black spots for eyes can be carefully painted on.

Battery Filler Used for Gluing

For applying small quantities of glue, a battery filler, or common ear syringe with a removable tip, has been found handy. Pour some glue into the rubber bulb using a small funnel, then replace the tip. Squeezing the bulb brings out the glue in any amount. A small nail or large tack can be used as a stopper to plug the open end of the tip to prevent the glue from drying out and closing the opening. —William A. Thomas, Chicago, Illinois.



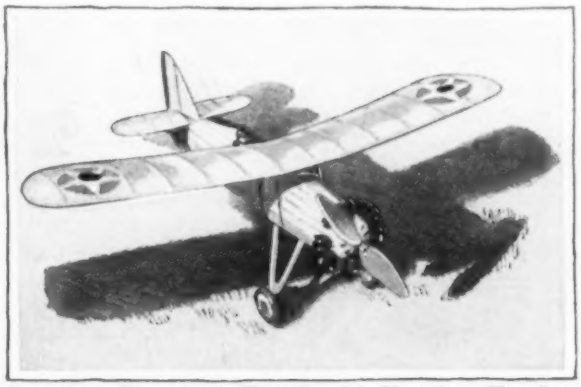
This Model Flies as Biplane or Monoplane

HERE is a splendid model plane that has performed well both as a biplane and as monoplane. The oval fuselage is gracefully streamlined. The construction of this fuselage has been greatly simplified in that the bulkhead frames are made up of only four pieces of 1/16-in. soft balsa, notched to be set over the longerons. This construction saves much time and cement over the older method of building up rectangular frames and cementing curved strips over them.

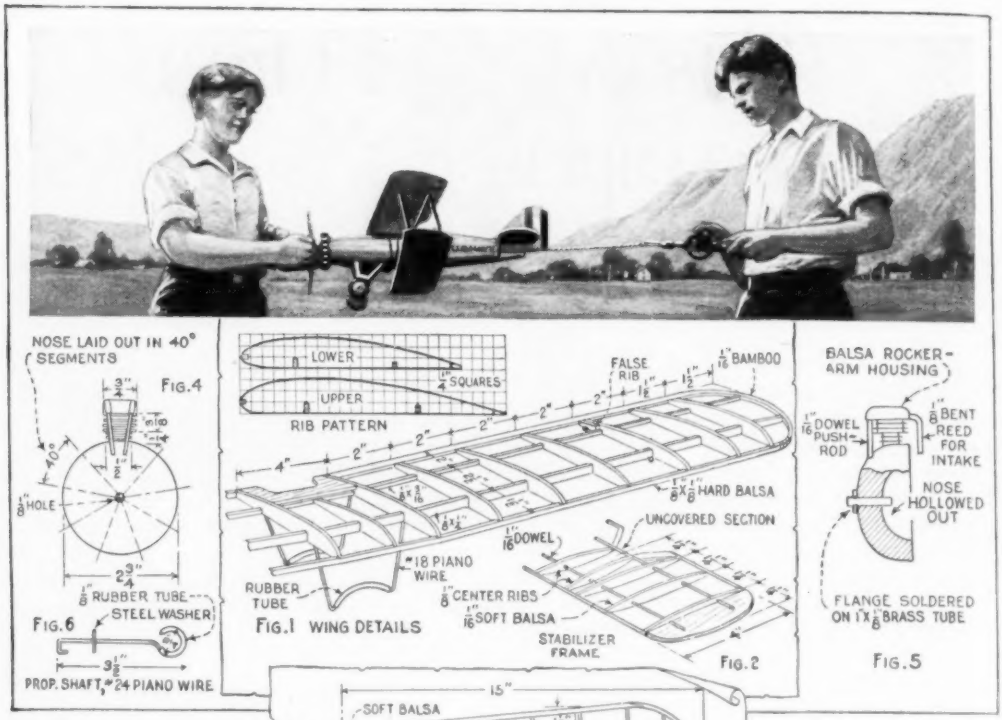
First make the nose, shown in Figs. 5 and 16, using a disk of soft balsa, 2¾ in. in diameter and 1¼ in. thick, with the grain at right angles to the axis. Before the front is rounded, locate the positions of the cork cylinders that are to be cemented on later. As there are nine cylinders, they will be set 40° apart as shown in Fig. 4. Drill a 1/16-in. hole in the edge of the disk at each location. These are for dowels that hold the cylinders on, Fig. 5, and the holes must not be effaced when finishing the nose. Drill a 1/8-in. hole through the center to receive the shaft bearing; hollow out the inside and round off the front.

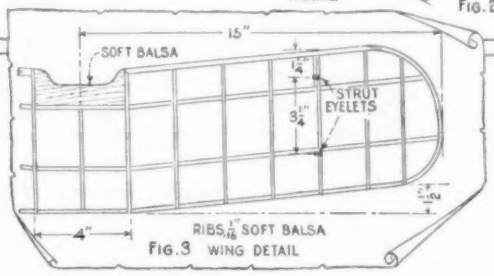
Next build the side frames of the fuselage, using 1/8-in. square medium-balsa longerons, 21 in. long, and 6 curved bulkheads of 1/16-in. soft balsa. These frames are spaced as shown in the perspective drawing Fig. 16, with the greatest dimensions at bulkhead No. 3, where the longerons are 2 in. apart across the top and bottom, and 3 in. apart from the top to the bottom. The exact details of this bulkhead and its dimensions, are given in Fig. 8. The other bulkheads are cut to conform to the curve of the longerons, the upper pair being spaced 2 in. from the lower pair at the nose and 1½ in. where they join at the tail. All joints should be neatly cemented together. Cut notches in the nose, about ¼ in. long and of such depth that the ends of the longerons will come flush. Cement in place, and insert a pair of diagonal braces of 1/8-in. square medium balsa between bulkheads No. 2 and 3. Install the 16 fairing strips of 1/16 by 1/8-in. soft balsa, evenly spaced, four between each pair of longerons. A ¼ by 3/8-in. piece of hard balsa, with an aluminum or brass tube running through the center, is used for the upright and the S-hook support at the tail. Fairing strips do not cover the extreme rear panels, as these are left open to get at the S-hook. A piece of soft balsa, tapered toward the front end, is cemented on top of this section.

The cockpit is located between bulkheads No. 3 and 4, and a cowling is made



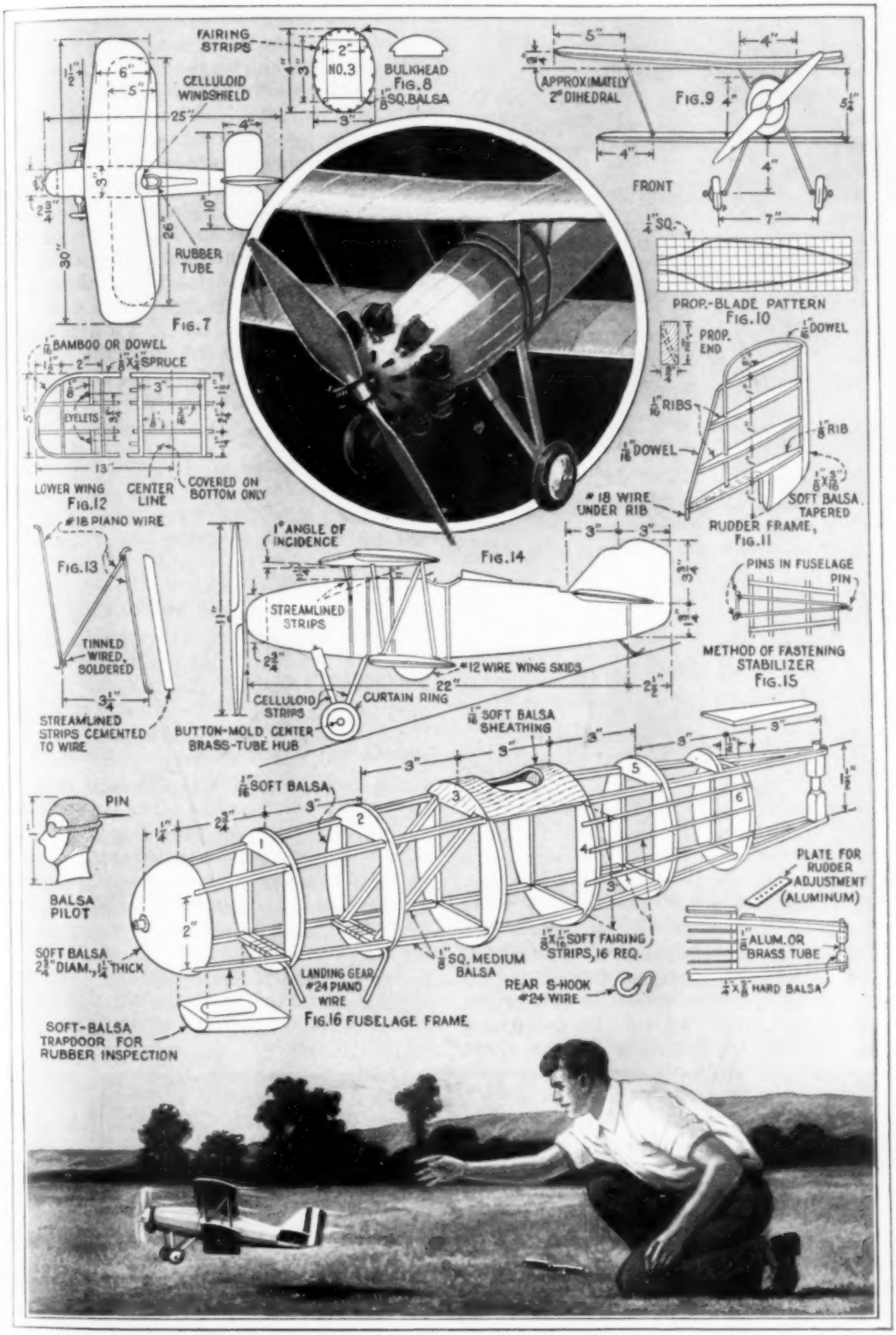
Streamlined Throughout, This Graceful Monoplane Has Been Found an Exceptional Performer





of thin sheet balsa. No. 24 piano wire is used for landing gear, attached in the manner illustrated, and carrying 2¼-in. wheels made of wood curtain rings for tires, button-mold disks, and hubs of ⅛-in. brass tubing, outside diameter, as shown in Fig. 14. A soft-balsa trapdoor under the fuselage, between the nose and bulkhead No. 1, completes the fuselage.

In building the wings, you will notice that the top one has a slight dihedral, Fig. 9, and a sweepback, Fig. 3 and 7, making it very effective in appearance, besides, of course, increasing its efficiency. The lower wing, Fig. 12, is flat and straight. In both wings, however, the tension of the doped covering will draw the tips up, but will not seriously affect performance. Forward spars are made of ⅛ by ¼-in., the rear ones of ⅛ by 3/16-in., the leading edge of ⅛ by ⅛-in. hard balsa, rounded in front, and the trailing edge of ⅛ by ¼-in. spruce, tapered toward the back. See Figs. 1 and 12. The tapering can be done with a small, sharp plane set for a very thin cut, finishing with fine sandpaper stretched over a flat block. The rib outlines are given in the details above Fig. 1, and show the locations of the entering and trailing edges, and spars. Use only a good grade of 1/16-in soft sheet balsa for the ribs, cutting them with a razor blade. The two central ribs on the lower wing, however, are made of ⅛-in. balsa and braced to adjoining ribs with two ⅛-in. pieces. To make the sweepback on the upper wing, bend the frame pieces to the required position, cement spars, ribs and edges together, and hold in place with pins on a flat board until the cement hardens. The dihedral on the upper wing should be about 2° so that the tips will be about ¾ in. higher than the center, as shown in Fig. 9. By setting the wing frame on two boards joined to form a 1° angle and holding them down with small weights until the cement has set, they will retain this angle until the paper is put on, and then the dope will


FAIRING STRIPS
CELLULOID WINDSHIELD
BULKHEAD FIG. 8
NO. 3
RUBBER TUBE
FIG. 7
APPROXIMATELY 2° DIHEDRAL
FIG. 9
FRONT
PROP.-BLADE PATTERN
FIG. 10
PROP. END
DOWEL
RIBS
RIB
SOFT BALSA, TAPERED
RUDDER FRAME, FIG. 11
#18 WIRE UNDER RIB
BAMBOO OR DOWEL
SPRUCE
EYELETS
LOWER WING FIG. 12
CENTER LINE
COVERED ON BOTTOM ONLY
#18 PIANO WIRE
FIG. 13
TINNED WIRE, SOLDERED
STREAMLINED STRIPS CEMENTED TO WIRE
1° ANGLE OF INCIDENCE
FIG. 14
STREAMLINED STRIPS
#12 WIRE WING SKIDS
CELLULOID STRIPS
CURTAIN RING
BUTTON-MOLD, CENTER BRASS-TUBE HUB
PINS IN FUSELAGE
METHOD OF FASTENING STABILIZER FIG. 15
SOFT BALSA SHEATHING
SOFT BALSA
PIN
BALSA PILOT
SOFT BALSA 2¾" DIAM., ¼" THICK
LANDING GEAR #24 PIANO WIRE
SQ. MEDIUM BALSA
SOFT FAIRING STRIPS, 16 REQ.
REAR S-HOOK #24 WIRE
PLATE FOR RUDDER ADJUSTMENT (ALUMINUM)
ALUM. OR BRASS TUBE
HARD BALSA
SOFT-BALSA TRAPDOOR FOR RUBBER INSPECTION
FIG. 16 FUSELAGE FRAME

With Certain Variations in Design, the Ship Has Been Modeled after a Vought "Corsair"

draw them up another degree. Curved wing tips, Fig. 1 and 12, can be made either of 1/16-in. bamboo or dowel stock, moistened and bent to shape over a candle flame or electric lamp. Upper-wing supports, which raise the wing above the fuselage about 1¼ in. at the leading edge and 1 in. at the trailing edge, are made of No. 18 or 20 piano wire, bent to the proper shape and covered with streamlined strips, as shown in Fig. 14. Eyelets or loops for the wing struts are made of No. 12 wire and are located as indicated in Figs. 3 and 12.

The rudder is formed of 1/16-in. dowel stock and pieces of balsa, Fig. 11. The rudder turns on a wire axle inserted in a metal tube at the tail end of the fuselage. Adjustment to port or starboard is made by means of a short wire at the leading edge, set in one of a number of small holes in an aluminum plate cemented to the top of the fuselage. Dowels, 1/16 in. in diameter, are used for the edges and spars in the stabilizer, Fig. 15, and sheet balsa forms the curved tips. The stabilizer is held to the fuselage with rubber bands, as are the wings. No dimensions are given for the length of the wing struts, as these must be fitted. They are made in the shape of a reverse letter "N," Fig. 13, the parts being bound together with tinned wire and soldered, while the streamlined balsa strips are cemented on. Wing skids of semicircular shape are attached to the underside of the lower-wing tips, and are made of No. 12 piano wire, indicated in Fig. 14. As this ship is powered with 12 or 14 strands of 3/16-in. flat rubber band, an 11-in. propeller can be used. It is the toothpick type, made of hard balsa and has a moderate pitch. The detail, Fig. 10, gives the pattern for the blades.

There is considerable work on the cork-cylinder motor, but it adds greatly to the appearance of this little craft. The cylinders are made of bottle corks, with the grooves between the cooling fins cut with a thin hacksaw blade and smoothed with a piece of fine sandpaper folded over the saw blade. For doing this on a lathe, or with a handdrill used as a lathe, cut the head off a small wood screw, clamp it in a chuck and screw the cork on. The rocker-arm housings are made of soft balsa, pushrods of small dowel or reed, and the intake pipes of reed. The cylinders, however, should not be put on until after the fuselage has been covered. Care must be taken in this part of the job. Use a good grade of rice paper, applying the glue lightly with the fingertip to the longerons, but not to the fairing strips. Separate strips of paper are required for the sides, top and bottom. Put on the side strips first, then the top and bottom strips. The wings should be covered on the bottom first, with glue applied only on the central ribs, the entering and trailing edges and the wing tips. Do not glue to the intermediate ribs. The same procedure applies to the rudder and stabilizer. After the glue has dried, put on two or more coats of dope, with time between for each to dry. Aluminum paint makes an effective finish for the entire ship, with the exception of the wing struts, tires, and cylinders, which should be black. A small pilot's head, carved from soft balsa, with helmet and goggles painted on, adds a realistic touch.

As all model builders know, a biplane is not as easy to fly as a monoplane, owing to the more intricate adjustment of two wings. Properly set, however, this model has been found to be an exceptional performer in both ways. The wings should have an angle of incidence of about 1°, Fig. 14, but as no two models built from the same plans are exactly alike, experiment may prove a slightly different setting more efficient. Generally, the plane will fly best with the leading edge of the upper

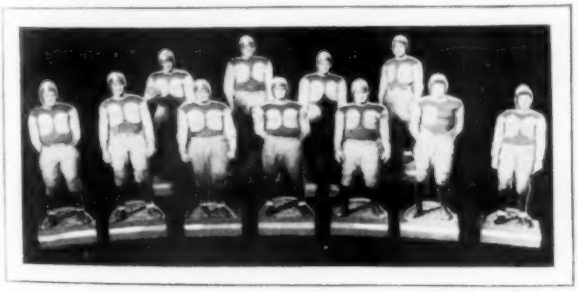
wing located directly over bulkhead No. 1, and the leading edge of the lower wing as far forward as the landing struts will permit. Adjustment of the trailing edge of the stabilizer is also a factor in proper flight. This can be raised by slipping a small piece of wood between it and the end of the fuselage. Try gliding it before taking off under power. At first, do not wind the bands more than 75 turns, but after the rubbers have been worked in, about 125 turns are a safe limit. To fly as a monoplane, simply remove the bottom wing and adjust the upper wing to the proper location, which should be determined by test gliding.

Glue Stiffens Limp Rugs

Small rugs that have become limp, have a tendency to be kicked up on every possible occasion, keeping the floor in an untidy state and offering a menacing obstacle to trip over. To re-size such a rug and give it the necessary stiffness, dissolve 1 lb. of granulated glue in 1 gal. of boiling water, tack the rug to the floor, face down, and apply the glue to the back with a whitewash brush. Leave in this position undisturbed until thoroughly dry.

Football Line-Up in Photo Cut-Outs

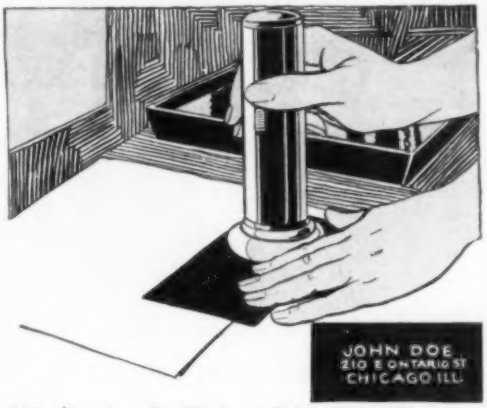
Photo cut-outs afford the school or individual fan an inexpensive method of maintaining a miniature hall of fame for the yearly crop of football heroes. Individual pictures of the players in uniform are pasted on cardboard and then cut out and mounted on wooden bases. The cut-outs are arranged in a group in which the picture of each player is inserted in his playing position, affording a realistic set. The same idea applies also to other sports.



Photos of Football or Basketball Players Glued on Cardboard Cutouts and Mounted on Small Blocks

How to Print on Photos

Printing your name on photos when developing them is easy to do. Have a show-card writer paint the name in black



This Negative Is Used to Print Your Name and Address on Photographs

on a white card. Make a photographic reduction, which can be transferred to the photo with the aid of a flashlight having a flat lens about 2 in. in diameter. After the print has been exposed in the usual manner, place the flashlight with the nameplate negative in contact with the print. Hold the plate tightly over the lens so that no light will leak through around the edges, and expose the print to a short flash with the light. After developing in the usual manner, the name will appear in black letters on the finished print.

Electric Iron Bends Bamboo for Model Airplane Parts

Heat an electric iron and set it up on end. Take the bamboo, after it has been cut to size, and bend it as near as possible to the desired shape. While it is being held in this position, place that part of it where the bend is sharpest, against the hot surface of the iron. The heat will soften the bamboo so that it can easily be bent. If the piece is to have more than one curve, or if the curve is very large, heat it in several places. Hold it against the iron until it gives, then remove and hold it in shape until cool. Blowing on it will hasten cooling. —John Louis Cato, St. Louis, Mo.

Ironing Board, Which Slides under Kitchen Table, Is Ideal for Use in Small Apartments

Ironing Board Slides under Table

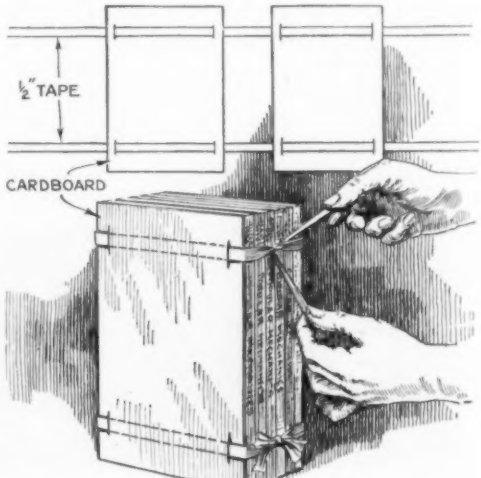
An ironing board that slides under the kitchen table will be appreciated by many women who live in small apartments and have only a few small articles to iron. A slot is cut in the end of the table frame for the board, and a notch for the single leg, which is hinged to the end of the board. With the leg folded up against the board and held there with a small hook at the end, both can be slid back under the table top. A cleat, screwed onto the under side of the board at its inner end, will serve as a stop to prevent the board from being pulled out too far.—Mrs. C. Harmon, South Bend, Ind.

Waterproofing Protects Canvas against Mildew

Unless canvas is waterproofed, it will deteriorate rapidly from mildew. The best grade of untreated cotton duck will last only from one to four years, but if properly waterproofed, it will be serviceable for eight to ten years. Painting white cotton duck with linseed or cottonseed oil is objectionable as this treatment reduces its strength and makes it inflammable and subject to spontaneous combustion. Canvas dyed with mineral dyes to a khaki color is strong, serviceable and waterproof. However, this kind of canvas is expensive and hard to obtain. A cheap but effective method of waterproofing canvas is as follows: Purchase 6 lb. of medium-hard petroleum asphalt, 2½ lb. of neutral or extracted wool grease and 1½ lb. of technical lead oleate. Place these materials in a can and melt slowly and carefully at as low a temperature as possible, stirring the mixture constantly. Also get 3 gal. of gasoline and 2 gal. of kerosene and mix them together. After the chemicals have melted entirely, remove them a safe distance from the fire and pour the liquid slowly into the gasoline-kerosene mixture, stirring constantly. If the ingredients settle to the bottom, heat the mixture in a can of hot water just before applying it to the canvas. In treating large tents or covers, a spray pump that will develop a pressure of at least 50 lb. can be used. Some loss of material results where the spray pump is used, but much time and labor are saved. Ten pounds of the chemicals and 5 gal. of gasoline and kerosene are sufficient to treat 40 sq. yd. of canvas.

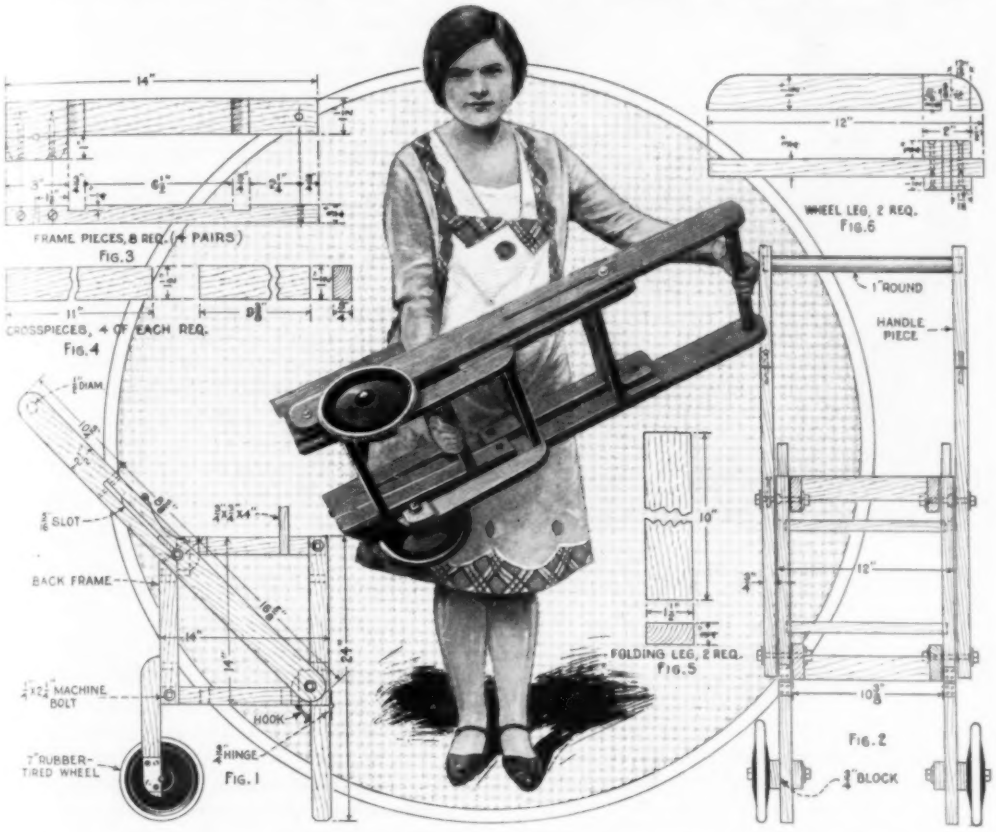
Cardboard Binding for Magazines

To keep a number of magazines together so that they will not be lost or mislaid, a cardboard binding will be found convenient. Cut two pieces of heavy cardboard just a trifle larger than the magazines. Make two slits near each side as indicated, pull a length of ½-in. tape through the slits and tie the ends of the tape together. Thus the magazines are always ready for reference.—H. Bosshard, Couvet, Switzerland.



This Neat Cardboard Binding Can Be Quickly Untied When Magazines Are Needed for Reference

A FOLDING CART TO CARRY THE CLOTHES BASKET



This collapsible cart places your clothes basket at the most convenient height and is pushed along while hanging or taking in the clothes. Figs. 1 and 2 show the cart assembled, and the other details show the two handle pieces and framework. Cut two lengths of 1 by 3-in. pine, 2 ft. 11¾ in. long, and round the ends. Drill a ¼-in. hole through one end, for bolts, and a 1-in. hole, ½ in. deep, in the other, for the handle. The slide slots are 5/16 in. wide and are made at the points indicated. Smooth the pieces with No. 1 sandpaper, rounding the sharp edges slightly. Fig. 3 shows one of the eight parts of the main frame. Cut a pattern from 1 by 2-in. stock, 14 in. long, marking the length of the others from it. Also lay out the first piece for dadoes, ¾ in. wide and ¼ in. deep, located 3 in. from each end. Cut the sides with a saw, keeping the blade in the waste wood while splitting the lines, and chisel to depth. When these parts are finished, cut blocks, ¾ by 1 by 3 in. in dimensions, drilling holes through the edges 1 in. from each end, and countersinking to take 2-in. No. 10 flat-head wood screws. Glue and screw the blocks at one end of each main frame member. Be sure to arrange the blocks to make four pairs of the frame pieces. On two of these, the ends of the blocks are rounded to clear the crosspieces when folding. Eight crosspieces, as shown in Fig. 4, are required. Four of these are 11 in. long, and the other four 9⅜ in. Glue and nail the ends of these into the dadoes of the main frame pieces. The two vertical frames take the 11-in. crosspieces, while the horizontal frames take the shorter ones. Square the frames, tacking strips diagonally across to hold them rigid until the glue has dried. Two folding legs, shown in Fig. 5, are hinged to the lower ends of the front frame, and two wheel legs are made as shown in Fig. 6. Two-

Easy to Push Along While Hanging Clothes, This Folding Cart Will Prove a Great Convenience

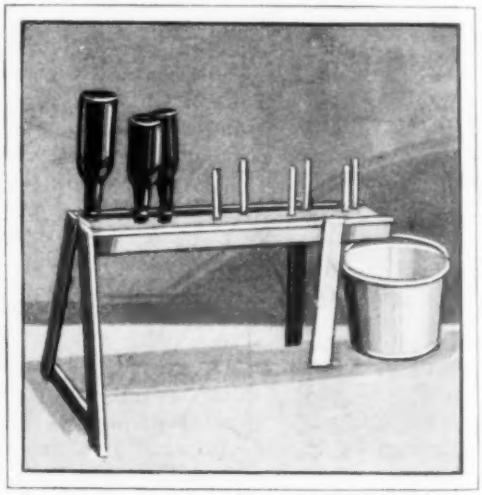
inch blocks, one ¾ in. and the other ½ in. thick, are screwed on at one end, and the dado is continued through them. Screw the wheel legs to the back frame, lapping the edges 4 in. When the frames are dry, remove the braces, and assemble the cart. Join the frames with ¼ by 2¼-in. machine bolts passed through from the outside, having the heads sunk into recesses and the pieces separated with washers. To hold the folding legs straight when open, provide a hook and screweye. Mount the cart on 7-in. rubber-tired wheels, using ⅜ by 4-in. bolts as axles, and placing washers between the wheels and the wood and under the nuts. Clamp the bolts in the dadoes with five-penny finishing nails driven obliquely. If desired, a ⅜-in. rod may be used as a single axle for both wheels. To hold the clothes basket in place, nail two ¾ by ¾ by 4-in. blocks to the sides of the upper frame. With the cart open, drill holes through the edges of the handle pieces, just above the through bolts, to receive spikes that prevent the bolts from sliding up the slots and allowing the cart to collapse. Drive screweyes into the upper edges of the handle pieces, and tie the nails to these with strings. To fold the cart, unhook the legs, push them back and then withdraw the slot nails, allowing the assembly to collapse. If the inner washers of the wheel bolts strike, drive them into the frame parts with a hammer. Drill holes through the upper ends of the handle-piece slots, to receive nails which lock the cart in the folded position. A coat of linseed oil will protect the wood, but if a paint finish is desired, remove the bolts and paint the parts separately, allowing them to dry before reassembling.

Truing Up an Oilstone

Oilstones are easily and quickly trued up without running the risk of spoiling them, as is often the case when they are held against an emery wheel, by grinding them on a planed cast-iron surface covered with a mixture of emery and water. Rubbing the stone back and forth across this surface will soon produce a smooth, true face.

Rack for Draining Bottles

Those who make beverages at home often find the draining of freshly washed bottles a tedious task. By building a rack as shown in the photo, a number of bottles can be drained at the same time without making a mess in the kitchen or basement. The drain board slopes toward one end so that the water will run into a pail. As soon as the last bottle is placed on the rack the first is ready to be removed, making the work continuous.



Rack Holds Washed Bottles for Draining and Water Runs Off into Pail

Wax Fastens Lamp Socket

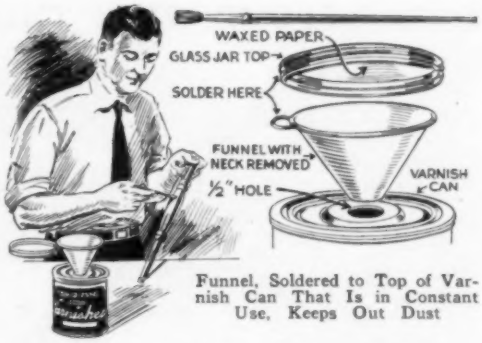
When converting a candlestick into an electric lamp, difficulty is often encountered in fastening the socket to the base. Drill a hole for the wires in the center of the candlestick. After the wires have been connected to the lamp socket, pour a quantity of hot sealing wax, battery tar, or a mixture of the two, into the candle hole and quickly press the socket in place, holding it there until the wax cools.

Feathers Transferred to New Pillows

To transfer feathers from one pillow to another, sew the new pillow shut with the exception of a small opening at one corner. Rip a similar opening in one corner of the old pillow and sew the edges of the openings together so that the feathers can be shaken from one pillow into the other. After this has been done rip the pillows apart and sew up the opening.

Tire Pump Used to Supply Pressure for Kerosene Container

After the pump on an old pressure-type kerosene can was found broken beyond repair, a valve stem was soldered in a hole punched through the top to permit the use of a tire pump, which was found entirely satisfactory for the purpose. If desired, any ordinary can having a screw cap on the cover can be quickly converted into a pressure tank by soldering in a valve stem and also a length of copper or brass tubing, bent over at the top end while the lower end is extended nearly to the bottom of the can, as shown in the drawing. The screw cap is fitted with cork or rubber gaskets to make it air-tight.



Funnel, Soldered to Top of Varnish Can That Is in Constant Use, Keeps Out Dust

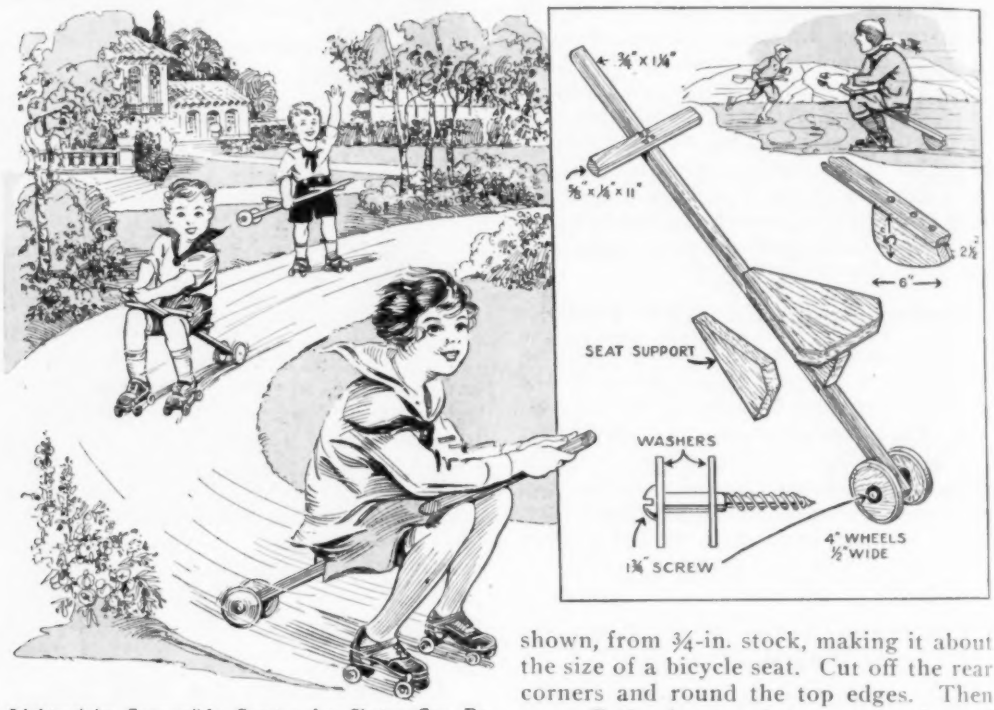
Keeping Dust Out of Varnish Can

When a small can of varnish is open for constant use, a considerable amount of dust gets in. To avoid this, cut or drill a hole through the lid and solder part of a tin funnel over the hole as shown in the drawing. Also solder a jar top with waxed paper on the inside to the ring on the edge of the funnel, which serves as a hinge. The varnish is then always accessible without the trouble of prying off the lid and replacing it.

Celluloid Cement Has Many Uses

Celluloid dissolved in acetone can be used as an adhesive, as a preservative varnish, or for purposes of strengthening porous materials by impregnation. Celluloid scraps are cut into fragments and put into a bottle until it is about one-fourth full, after which enough acetone is added to fill the container about three-fourths. Shaking the bottle will help dissolve the mixture until it assumes the consistency of a sirup, which may be thickened by exposure to the air to form a cement, or thinned by adding more acetone and shaking. The solution should be as free from water as possible, as the varnish tends to whiten on drying if it contains water. When dry, this cement has great strength, is air-tight and waterproof, yet flexible. It is attacked by few chemicals and can be colored by adding a dye. It is valuable in repairing glass, amber, pottery, porcelain, ivory, enamel and like substances. As a varnish, it is useful to cover metallic surfaces to prevent oxidation, and may be applied by brushing, dipping or spraying. For fine fabrics, the varnish is diluted with acetone and applied with an atomizer.

GREAT SPORT WITH THIS ROLLER-SKATE COASTER



Lightweight Convertible Coaster for Skates Can Be Used Both Summer and Winter

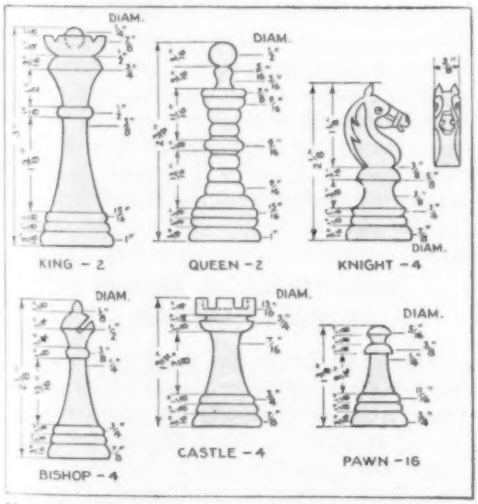
Here is a coaster you can use with your roller skates. It is so light that you can easily carry it in one hand and either sit down to coast after getting up speed or use it on hills. When winter comes, simply take off the wheels and substitute a single runner underneath and use it on ice or for coasting. A crosspiece near the front makes riding comfortable, as it rests on the knees. In this manner a three-point support is provided, your skates forming two in front, and the pair of wheels behind, the third. To make it, get a piece of hardwood 32 to 40 in. long, depending on the size of coaster desired, and taper the board from ¾ by 1¼ in. at one end to ¾ by 2½ in. at the other. From ½ or ¾-in. hardwood, cut two wheels 4 in. in diameter. Either turn them out on a lathe or cut them with a jig or coping saw. Fasten them to the wide end of the stick with 2½-in. wood screws, using a washer on both sides to reduce friction. Also grease the screws. Taper the wheels to ¼ in. in width at the edge, for smoother running. Cut out a triangular seat as shown, from ¾-in. stock, making it about the size of a bicycle seat. Cut off the rear corners and round the top edges. Then saw off the front point at an angle, and cut a support block to fit between the seat and the stick, which will hold the seat in a horizontal position when in use. A little experimenting will give you the most convenient angles to use. After attaching the seat temporarily put your skates on and sit on the coaster, holding up the handle, and determine the best location for the seat and knee brace, after which they are permanently nailed or screwed on. The knee brace should be about ⅝ by 1¼ by 11 in., and the edges rounded off for comfort. To obtain a strong joint, glue the contacting surfaces of the seat and knee brace before nailing. To change the coaster for winter use with ice skates, remove the screws holding the wheels and provide a single runner of the size shown in the detail. Glue and fasten with screws to the underside of the stick as shown. Go over the whole job with a double coat of red, yellow or white paint. A strip of light strap iron or heavy galvanized sheet iron will make the edge of the runner more durable. Nails or screws used on the underside of the runner should, of course, be countersunk and filed flush.

Oil-and-Charcoal Mixture Preserves Fence Posts

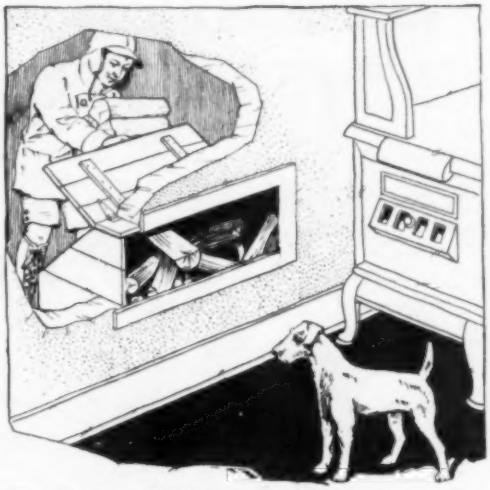
Almost any kind of wood used for fence posts, can be made to last if coated with a solution consisting of boiled linseed oil in which pulverized charcoal has been stirred to the consistency of paint. This mixture is cheap, easy to prepare and is applied with an ordinary paintbrush. A number of poplar posts left in the ground for seven years were found to be as sound and free from defects as they were when new. The paint should, of course, be allowed to dry before putting the posts in the ground.—Chas. Illingworth, Vancouver, B. C., Can.

Turning a Set of Chessmen

Turning a set of chessmen is an interesting job for any amateur woodworker. The white men are made of birch or maple and the others of mahogany or walnut. All the pieces are mounted on a screw chuck. Be sure to use sharp tools and very little sandpaper. Dimensions are given in the drawing, but these can be varied somewhat to suit your taste. The knights with carved heads may seem hard to make, but with a little care and patience the job can be done by anyone. Finish with a small file and sandpaper. After turning the pieces, sand them carefully and then give them three coats of shellac, polishing each coat with powdered pumicestone and oil.



Here Are All the Necessary Dimensions for Turning an Attractive Set of Chessmen



This Built-In Woodbox for the Farm Kitchen Can Be Filled from the Outside

Kitchen Woodbox Filled Outdoors

It will be found convenient to build a wood box for the farm kitchen that can be filled from the outside, as shown in the drawing. An opening through the wall allows access to the box from the inside, and it will be found best to provide a hinged door for the opening to keep out the cold.

Hookless Fastener Closes Hole in Auto Curtain

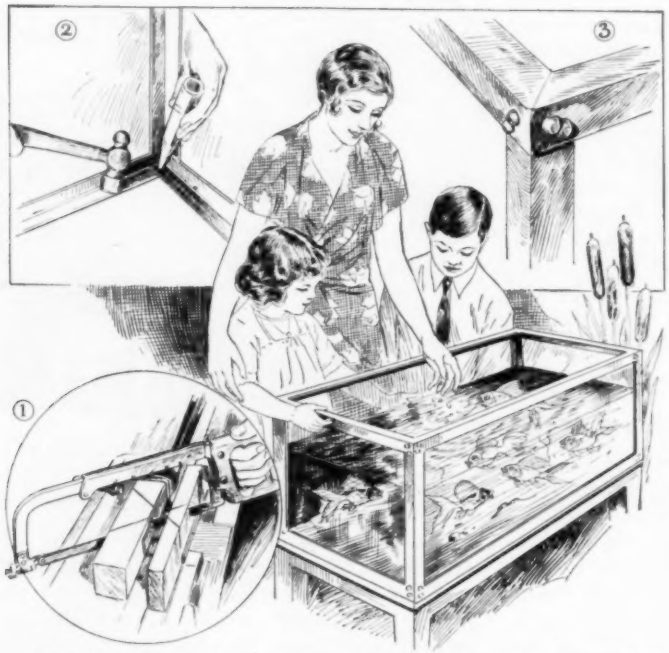
When driving a car with side curtains, an opening through the curtain on the driver's side is convenient for signaling a motorist behind. Instead of using a flap to cover the opening, provide a hookless fastener. When the opening is not needed constantly, it can be closed tight to keep out the cold air.

Water Used to Lower Tank into Pit

After digging a hole for a large gasoline-storage tank, a western man found the container too large for him to lower alone. He had no help, but finally solved the problem by filling the hole with water, rolling the tank in and then pumping out the water. The tank settled safely and easily to the bottom.

¶To tighten loose doorknobs, wrap two or three turns of ½-in. adhesive tape around the shank at the setscrew.

AUTO GLASS USED TO MAKE A LARGE AQUARIUM



A Plate-Glass Aquarium with a Frame of Angle-Iron Will Accommodate a Large Number of Goldfish

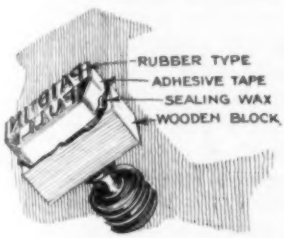
With four pieces of plate glass, a length of angle iron, a few iron rivets and some homemade cement, you can build a large goldfish aquarium holding over 20 gal. of water for less than $5. The glass can be obtained from an automobile junk yard. Rear windows of closed cars are used, as their size is most suitable for the purpose, each piece being approximately 29⅝ by 13¾ in. in dimensions. For the framework, a length of 1 by 1 by ⅛-in. angle iron is needed. Dimensions for the glass and iron can be varied to suit the size of the aquarium desired. The frame should be slightly larger than the glass, so that the cement will seal the edges completely. Where the ends of the iron are joined, as shown in Fig. 3, they are cut at a 45° angle by using a miter box as shown in Fig. 1. Iron rivets, cut fairly short and with heads on the outside, are used to assemble the frame, as shown in Fig. 2, although welding is better. Holes for rivets are drilled while the pieces are held together in a vise in order to assure accuracy. The cement used consists of plaster of paris, 6 oz.; fine, washed sand, 6 oz.; powdered rosin, 2 oz.; enough linseed oil to form a stiff paste, and a small quantity of drier, the last two ingredients being obtainable at a paint or hardware store, and the others at a drug store. The cement is applied generously, so that it completely fills up the space between the frame and the glass. Two batches of cement made in the proportions given may be required. Allow several days for setting. For patching small holes, another cement is made of litharge moistened with glycerine to form a paste, which will dry as hard as stone. This cement is excellent for making water-tight joints, but it is too costly for use on the entire aquarium. Support the glass with braces and clamps until the cement dries. When finished, sandpaper the frame, and paint or lacquer it in the color desired. The weight of a water-filled tank makes it necessary to provide a sturdy support. Fish authorities recommend 20 sq. in. of surface area in a tank for each linear inch of fish, which one should take into consideration when stocking the tank. Such a large aquarium should also be provided with adequate plant growth to supply oxygen to the water and a number of snails or other scavengers to keep the water clean. Place a 2 or 3-in. layer of sand on the bottom to provide rooting for the plants.

Swiss Method of Producing Gun-Metal Finish

Gun-metal finish on metal can be produced with a solution consisting of 48 oz. water, 7 oz. chloride of iron, ¼ oz. hydrochloric acid, and a ¼ oz. copper sulphate. These are mixed in the order given and kept in dark bottles until ready for use. The parts to be treated are first polished

with fine emery dust and oil, and then wiped thoroughly clean of the oil. An even coating of the solution is applied with an old sponge. The metal will first turn to a light copper color. Let it dry for half an hour, or more if necessary, until a greenish color appears. Then place the article in the oven, heated to a temperature of about 212° F., and leave it there about 15 minutes until the color turns to a dark brown. This is the oxide of iron. Now give the article a thorough steaming over the spout of a water kettle, and then immerse it in boiling water, leaving it there for about half an hour until the color turns black. Dry the article, rub it with good flannel, and if a rustproof finish is desired, apply a thin coat of boiled linseed oil, and dry in an oven. This is the process used by the Swiss on watchcases. It is safe, requires no special tools and can be done at home. Use only as much of the solution as needed and do not pour the surplus or used liquid back into the bottle.

Homemade Rubber Stamps



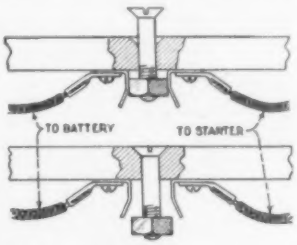
Most users of rubber-type printing sets have many surplus letters but no extra holders. Good stamps can be made by binding each line of type with a narrow strip of adhesive tape, and then holding the lines together in the same way. After you have assembled the letters completely, taking care to get the type level, place the letters, face down, on a flat surface and press a small wooden block, with melted sealing wax on one side, against the back of the type.

Glue Helps to Extract Slivers

Small splinters that are difficult to remove from the flesh with a needle, can sometimes be extracted by applying liquid glue, celluloid cement or collodion. Let the glue dry thoroughly, then peel it off with a single motion. Usually, the splinter will be dragged along with it.

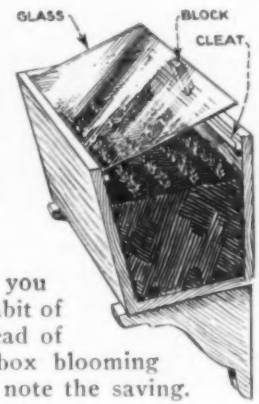
Secret Lock in Ignition Circuit

Anyone can readily install this secret lock in the ignition circuit of his car. Drill a hole through the floorboard to receive a flat-head machine screw. Countersink the hole so that the top of the screw comes flush. On the underside of the floorboard screw two angles made of spring brass, which will grip the nut on the end of the screw securely when the screw is pulled up. The end of the screw is peened over to prevent the nut from coming off, or two nuts can be used, being driven together to lock each other. One lead of the low-tension side of the ignition circuit is cut, and leads from the two ends connected to the brass angles, as shown. When the car is left, the screw is pushed down flush with the floor where its service as a switch will never be suspected. When the ignition current is needed, the screw is pulled up so that the nuts are wedged between the brass angles.

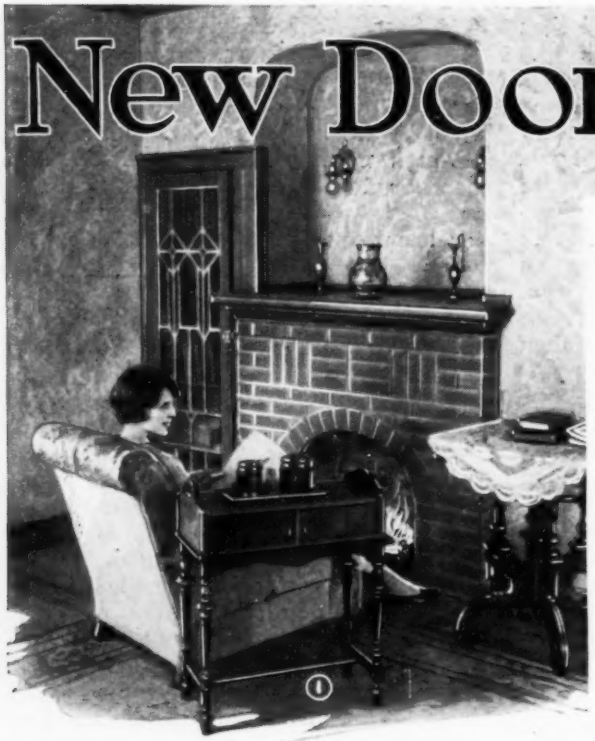


Starting the Flower Box Early

In order to get an early start with the flower box, first put a layer of manure in the bottom and then fill up with black dirt. Nail a couple of cleats on the inside of the box to hold a pane of glass, which is cut to fit, and then plant your seeds. This arrangement provides a miniature hotbed and makes it possible to plant the seeds several weeks ahead of the usual time so that the seedlings will be quite large when warm weather arrives. If you have been in the habit of buying plants instead of seeds, to have a box blooming early, try this and note the saving.



New Doorways



ANY home where the dining room is connected with the living room by a narrow hinged door, can be modernized, beautified and made apparently larger by simply removing the door and substituting a large arched doorway. Thus, for instance, the doorway shown in Fig. 2 originally was merely a single door.

Before tearing down the old door, the arch must be carefully planned, and it is advisable to mark it off on the wall. The top line will be at the same height as the old one but the sides of the archway may be extended as far as desired. The first step is the removal of the old door and framework. As this can sometimes be resold, try to take it down without damaging the wood. Next, the plaster and lath is cut out along the lines laid out on the wall, using a keyhole saw for the curved portions and a crosscut saw for the straight lines. This part of the work is simply a matter of "saw, man, saw," and one must keep at it until the entire cut-out is made. Do not attempt to cut through both sides of the wall at once, as this tends to loosen the plaster on the wall opposite the side you are working from, and makes it necessary to do considerable replastering. Carefully done, the plaster and lath can be cut easily and without much plaster breaking off. Bore a hole with an auger for starting the cut with a keyhole saw. If the baseboard has not been removed entirely, one must remember, when sawing, that the corners must project sufficiently to take care of a miter joint, and the baseboard should, therefore, not be sawed off in line with the plaster cut. It is better to remove the baseboard and replace it later.

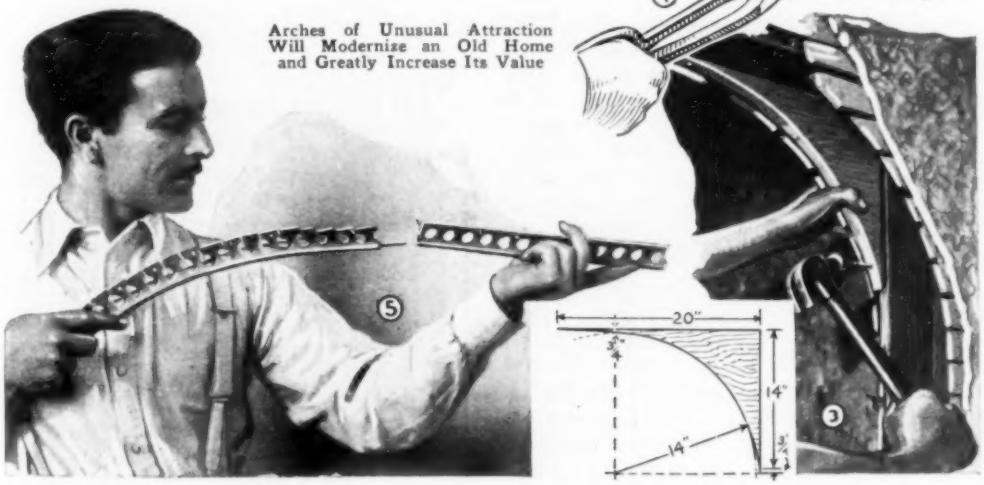
The double studs to which the old door frame was attached can be used again in the new by merely changing their position. Reset them inside of the wall and flush with the edge of the cut-out. The top crosspiece or header will, of course, be too short for the new doorway and must be replaced with a longer one. The cut ends of the lath are then nailed to the frame. The next item on the material list consists of four arched pieces of 1-in. lumber, cut more or less to the shape shown in Fig. 3. If you wish a completely rounded arch, these pieces must be cut to carry out the required curve, but if you merely desire to round the corners, you can use the dimensions given in the detail. Doorways with little or no arch, as in Fig. 2, can be made to look quite attractive. The curved pieces are nailed to the framework and lath is then tacked on across them, allowing enough space between adjacent pieces to permit the plaster to anchor properly. The lathing is carried entirely around the doorway, and metal beading is then nailed over the corners as shown in Fig. 6. This material comes in 8-ft. lengths, and can be purchased from any dealer in building supplies. For an archway about 7 ft. high by 5 ft. wide you will need six lengths. In order to allow

for Old

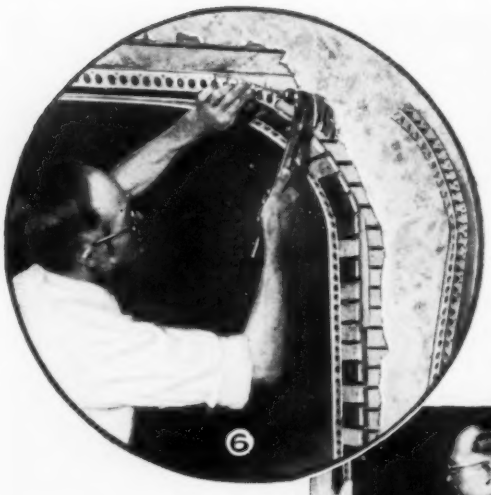
by Robert Gregg

the metal strip to go around the curve nicely, it must be cut on either side of every nail hole as shown in Fig. 4, and all joining ends of the beading should be held together with a finishing nail, as in Fig. 5. It is obvious that no great skill is needed in putting on this beading, but the task requires care so that the curve and general form of the arch will be true and free from humps or hollows. Applying the plaster is no trick, even if you have never handled a trowel in your life. By using wood-pulp plaster, almost any man can manage this bit of "mud slinging" and make a good job. (See Fig. 7.) Full instructions for mixing the plaster should be obtained from the dealer, and depends on the kind you get. Recutting and fitting the old baseboard to the new archway completes the job. The edges are mitered to fit accurately. In the case of many old houses, the flooring extends completely through the house from room to room, and needs no attention other than scraping, sandpapering and finishing with filler and varnish stain to blend with the rest of the flooring. New paper or other wall finish, which is to go on immediately after the plaster is set, should be the same in both rooms as it covers the arch also.

Stairways can often be improved by using arched



Arches of Unusual Attraction Will Modernize an Old Home and Greatly Increase Its Value



doorways. A window at the lower landing helps considerably to lighten the adjacent room. Similarily, the interior of a room can be improved by building arched recesses in the wall, as, for instance, over a fireplace, which provides an attractive mantelpiece, Fig. 1. Outside doors, especially the front door, can be modernized by working along the same general lines, although the job is more difficult, particularly in the case of brick houses. After you have graduated from the work of making interior arches, you might tackle an outside job, but not before.

In designing arches, an unlimited number of variations are possible. The basic idea can be applied all the way from a built-in bathtub to a cozy breakfast nook in the kitchen. Arched windows, while involving a trifle more work and costing more, are also practical projects when remodeling. And why stop at one arch? Between large rooms several arches in one wall have been found practical.

Renewing Old Clocks

Old pendulum clocks can often be given a new lease on life by drawing up the rod that holds the pendulum, and bending it over ⅛ in. This renews the spring in the upper end of the wire, which helps to make the clock go. To compensate for the shortening of the wire, screw the pendulum down the same distance that the rod was drawn up. Pendulum clocks that have stopped after many years of service have often been put into good order by this simple method.—C. R. McClelland, Monessen, Pa.

Solution Keeps Photo Prints Flat

To keep photographic prints from curling or cracking while drying, soak them for a few moments in a solution consisting of 1 oz. glycerine and 20 oz. water. It will last indefinitely and can be applied to glossy or matt papers. Prints thus treated will lie flat and remain soft and pliable after they are dry. If weather conditions are such that this treatment is not sufficiently effective, use more glycerine.

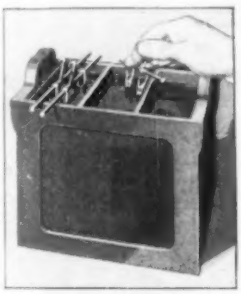
Sliding Shelves Save Space

In small stores and shops where wall space is rather limited, a number of sliding shelves, as shown in the photo, will be found convenient for holding glass jars containing small parts. One section of the shelving is built rigidly against the wall in the usual way, and its width should be just sufficient to accommodate the jars. Two sections of shelving of the same width are built to slide in front of the stationary shelf, suitable runners being provided to permit the shelving to be moved about so that one can get at any jar without trouble.—Geo. R. Harrison, Council Bluffs, Iowa.

Sliding Shelving in a Store Holds Hundreds of Glass Jars Filled with Small Parts

A Battery-Case "Darkroom"

The case of a three-cell storage battery makes an excellent container for developing solution for cut-film, plate or film-pack negatives. The solution is placed in one of the end compartments, water in the middle one, and the fixing bath in the other. Negatives are held by means of film clips or plate hangers. The normal battery case will take negatives of 4 by 5-in. size and smaller. The developer used should be one that remains active over a long period, so that the tank need not be emptied frequently. The level of the liquids should be kept sufficiently far below the top of the partitions to keep them from running over into adjoining compartments. If it is found that the developer or hypo baths creep up over the edges, paint the edges with melted paraffin. The cells can be emptied individually by means of a siphon, started by a rubber bulb. One-piece containers of this kind can be obtained from most battery-service stations for a small sum. They should be thoroughly cleaned before they are put to use for this purpose.

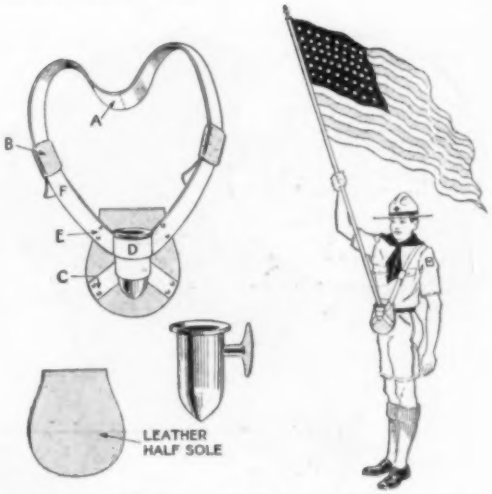


Hole in Chimney Improves Draft

One cause of insufficient draft in chimneys at the cellar opening is the formation of a vacuum in the chamber below the furnace by the hot air and gases that rush up the chimney. When air moves down to fill the vacuum, the draft is momentarily checked. The trouble can be remedied by making a small hole in the chimney wall above all accumulations of dirt and soot.

Keeping Auto Floor Clean

Removing dust and dirt from the floor mat in the model-A Ford cars is simplified by nailing a triangular wooden strip to the floorboard just inside the sills and placing the mat on top of it. This raises the mat so that the dirt can be swept out.



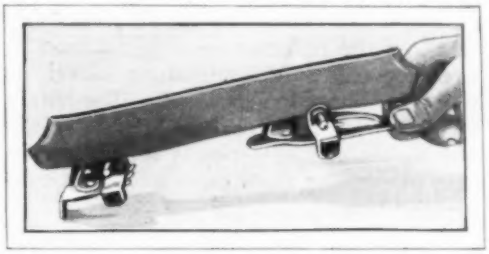
A Bakelite Ash Tray, a Halfsole and Two Belts Make This Flag Sling for the Scout Parade

A Flag Sling for Boy Scouts

When a flag sling is needed for the parade, get a bakelite or hard-rubber ash tray of the kind fitted with a suction cup, a composition half-sole, two leather or composition belts with slide buckles, and eight ¼-in. brass rivets. Cut the belts in half and sew the cut ends together at A. Rivet the tongues of the belts to the halfsole at four points, C and E, wrapping them tightly around the ash tray as shown at point D, after the suction cup has been removed. The tongues are run through the slide buckles and the straps can be slipped over one's shoulder.

Inner Tubes Protect Skates

Guards to protect skate runners can be made from inner tubes. Cut two pieces, each about 1½ in. wide, and pull them over the blades. No buckles or other fastenings are needed.



Sections of Inner Tube Stretched over Skate Runners Protect Them from Damage

Night Workers, Who Have to Use a Flashlight Constantly, Will Appreciate This Variation

Stubby Flashlight Gets "Juice" from Pocket Battery

Railroad inspectors, and others who have to use a flashlight regularly in their work, will find the illustrated stubby flashlight highly convenient. It is suspended from the neck on a length of lampcord which also serves to connect it to the batteries carried in the pocket. While it takes the place of any ordinary flashlight, it will be found especially handy when it is necessary to use both hands in writing in a notebook, as the latter can be held in the light while the flashlight is suspended. To make it, cut off the front end of an old metal flashlight case, get a standard push-switch socket, a candelabra socket and a miniature socket. The three sockets are screwed together as shown in the detail, after which the cut end of the flashlight case is slipped over the end of the standard socket and soldered to it. The case must, of course, be cut off sufficiently to allow the reflector to come against or over the end of the miniature socket, so that a lamp can be screwed in. The length of lampcord connected to both the standard socket and batteries is looped to enable suspension from one's neck at a convenient height.

¶Buttons can be arranged in assorted sizes or colors by stringing them on safety pins; this method will keep the sewing box in good order, and makes for easy matching of the buttons.

Curing a Sticky Waffle Iron

If the batter in your waffle iron sticks, try the following method: Turn on the current to the waffle iron, and after it has become hot, rub paraffin over the plates and close the lid. Wrap a wet towel around the iron and let the paraffin boil for 10 to 15 minutes. Remove the towel, and brush the hot surfaces of the plates with a steel brush or with steel wool. Then clean off with warm water, being careful to remove all traces of the steel wool. After this treatment, the waffle iron will not give any more trouble.

Self-Locking Spring Connectors

For those who experiment with electricity, these quickly made, self-locking spring connectors for clipping wires to terminals temporarily, will be found useful when regular clips are not at hand. Strips of spring brass, about 4 in. long, are drilled at one end and about 1 in. from the other end, after which the strip is rolled so that the holes nearly come into alinement. By squeezing the strip until the holes coincide, it can be slipped over the terminal, and its tendency to pull apart locks the clip on the terminal. The clips are soldered to one end of the wire, and if necessary, the straight part can be wrapped with tape, in order to make the connection stronger.

Rubber Band Keeps Windshield Wiper Out of Way

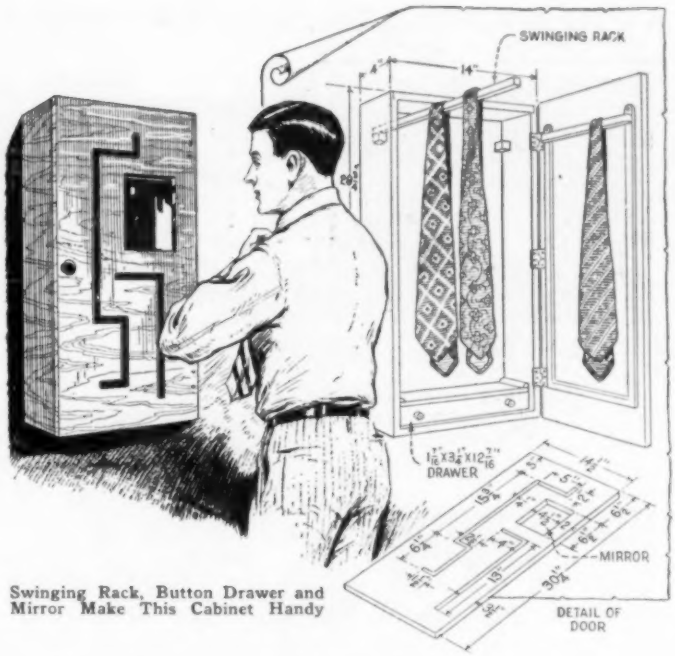
Loop an elastic band over the blade of your windshield wiper and then pass the free end over the body of the wiper motor. This will keep the wiper out of the line of vision when not in use, and no harm will result should you forget to remove the band when the wiper is turned on, although the band will of course, hamper its operation.—F. H. Friedel, San Bernardino, Calif.

Speeding Up the Setting of Plaster of Paris

Although plaster of paris sets in a fairly short time, it is sometimes a great convenience to have it set still more quickly. To do this, add one teaspoonful of salt to each pound of dry plaster and mix well. Then add the required amount of water, preferably hot, and mix quickly. When the mixture is free from lumps, pour it into the mold without the least delay, as the setting will take place rapidly. The process can be slowed up a trifle by using cold water instead of hot, but in either case the set will take less than two minutes. The more salt added per pound of plaster, and the hotter the water, the less will be the time required for setting. Some casts have set in less than a minute, a fact that will interest workers in plaster casts.

Door Hook Serves as Lock

By making a few changes in a flat-iron door hook, it can be made to serve as an efficient lock, which is tamper-proof from the outside. At the pivot end a number of holes are drilled to form an L-shaped slot which is filed smooth to receive a wood screw of suitable size. A notch is filed at the end which engages with the staple. The hook is installed at a slant so that it will have a tendency to slide toward the locked position. The latch is lifted by pushing the pivot end and then removing the hook from the staple in the usual way.



Swinging Rack, Button Drawer and Mirror Make This Cabinet Handy

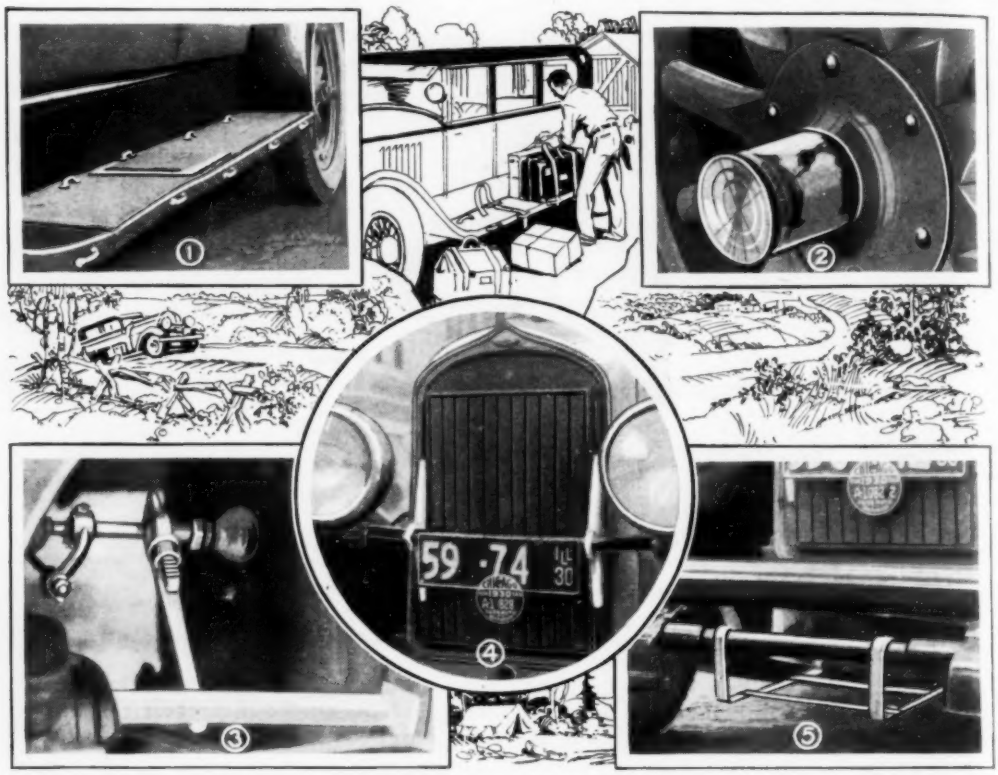
A Cabinet for Your Neckties

Replacing the familiar rack, this cabinet for your neckties will protect them from dust and also provide a place for cuff and collar buttons, tie pins, etc. A mirror, set at the right height, will also be found useful and the door may be inlaid to make it more attractive. One rack is fastened to the back of the door while the other rack is pivoted to a bracket screwed to the side near the top, so that it can be swung outward. All necessary dimensions are given in the drawing. The sides can be made of ¾-in. poplar, the back from a piece of composition board, and the door is cut from three-ply veneer. The cabinet is mounted on the wall on wood screws at a suitable height.

Proper Humidity Helps Chicks Break Shells

By placing a can of water in an incubator a few days before the eggs are to hatch, chicks will be better able to break the shells. The lid should be perforated with holes to allow evaporation and to prevent the chicks from falling into the can if it is shallow.—G. R. Dyment, Hamilton, Can.

AUTO SHORTCUTS THAT ARE WORTH REMEMBERING



Luggage Straps and Holders, Emergency Hub Caps, and Shutters That Won't Cause Radiator Leaks, Are a Few Shortcuts Worth Remembering by Motorists

Luggage loops for the running board, as shown in Fig. 1, are out of the way when not in use but always at hand when needed for packing large, clumsy objects, such as tents, suitcases, etc. A number of stout straps for tying down the load are kept under the rear seat. Campers will find these fittings a great convenience. Another method of providing a luggage carrier is shown in Fig. 5. Made of strap iron about ¾ or 1 in. wide to hook over the front crosspiece of the frame, this basket is fastened at the rear to the splash apron below the radiator, using ⅜-in. bolts. The crosspieces of the basket are bent over and clinched to the sides, or, if desired, they may be welded on. Drilling holes at these points weakens the basket, and therefore it is not advisable to bolt the parts together. When the basket is finished, give it a coat of black paint or auto enamel.

When your hub cap comes off and immediate replacement is impossible, substitute an empty tin can of suitable size to fit over the flange on the wheel, as shown in Fig. 2. This is an excellent emergency method of keeping sand and dust out.

In adjusting brakes, the problem of holding the brake fully applied is quickly accomplished, as shown in Fig. 3. A good way is to apply a 10-in. pipe wrench on the brake-rod arm in the direction that sets the brake, and hold it in position with a tire tool that is placed across the handle with one end butted against the frame or heavy fitting of the car and the other projected through the spokes of the wheel. Turning the wheel forward locks the brakes and holds the wheel, permitting one to reset the lever in the usual way.

Radiator shutters, that are fastened by means of long screws pushed through the openings between the fins, sometimes have the disadvantage of causing a radia-

tor leak, owing to the pressure and vibrations of the screws. To clamp the shutter securely in position from the outside, eliminating the need of screws, make a couple of hardwood wedges, as shown in Fig. 4, clamping these to the lamp bracket. Make the wedges about 8 in. long. After they are pressed down behind the lamp brackets, screw on pipe straps to keep them in this position.

Removing Stains from Marble

Iron stains on marble can be removed by applying a solution of sodium citrate, followed by sodium hydrosulphite in dry form, and then covering with a paste of whiting and water. A poultice of whiting, soap solution and sodium carbonate will efface tobacco stains, while ordinary ink stains can often be deleted with a solution of whiting and sodium perborate, followed by a few applications of the sodium-citrate solution.

Hook for Catching Fowl

For catching crated fowl, a length of heavy wire with one end bent over to form a hook with about ¾-in. clearance will be found highly convenient. In use, the hook is slipped over the fowl's leg so that it cannot get away, and it is then an easy matter to reach in and pull the fowl out. If the hook is attached to a longer pole, it can be used for catching fowl in the lot.—J. N. Stoody, Kenosha, Wis.

Catching Fowl in a Crate or Lot Is Easy with the Aid of This Wire Hook

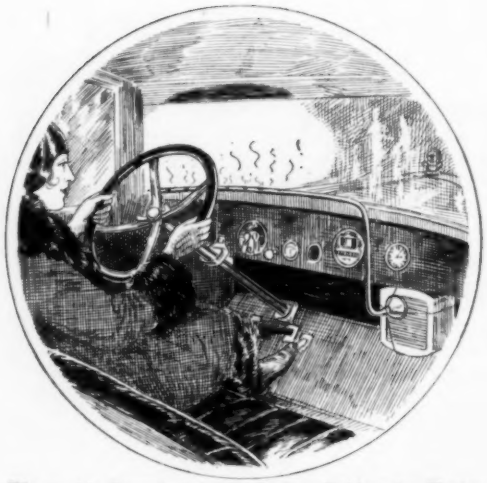
This Wooden Guard with Hinged Flap, Keeps Snow Away from Outside Doors

Wooden Guard Keeps Snow from Door

When snow is drifting against doors, the wooden guard shown in the drawing will be found useful. A 12-in. board is nailed over the door tread a few inches from the door and a wooden flap is hinged to the upper edge. Ordinarily the flap is kept closed against the door, which prevents snow from accumulating between the guard and the door. When the door must be opened, the flap is pulled back. The guard keeps snow out of places where it might prevent closing the door.

Paper Makes Water-Tight Seams in Sheet-Metal Containers

Water-tight seams in sheet-metal containers can be made without the use of solder by employing paper in the following way: Bend the edges of the sheet metal to interlock. Before joining them, get a strip of medium-weight wrapping paper, about 2 in. wide, and fold it so it can be laid in the turned edge of the under metal sheet. The edge of the other piece is hooked in place, making sure that the paper fits well in the joint, and the seam is then hammered together in the usual way. Excess paper is trimmed off. On long seams, rivets may be used every 8 or 10 in. Paper can also be used in the seam where the sides and bottom join. In this case, a piece 2 in. larger in diameter than the bottom should be used. The seam is made in the usual way and no rivets are needed. In use, the paper inside of the seam swells and makes a tight joint.—Francis Wilkin, Pittsburgh, Pa.



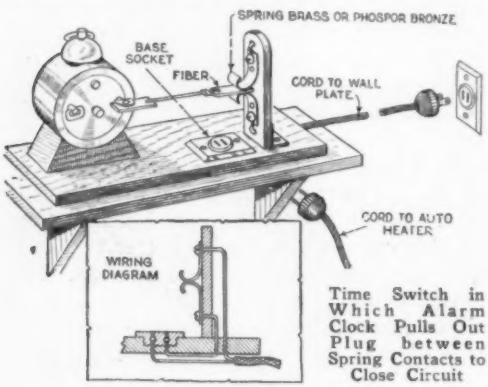
Warm Air Forced through Copper Tubing by Heater Keeps the Windshield Clear

Warm Air Keeps Windshield Clear

Warm air from the water or manifold heater in the car can be used to keep the windshield free from frost. A length of ¼-in. copper tubing is soldered to the spout of a small funnel, which is attached directly in front of the heater, as shown in the drawing, so that warm air will be driven through the tubing. The tubing is run up and along the lower edge of the windshield, the end being pinched shut and a number of holes drilled in the side, about 4 in. apart, to direct warm air against the glass.—E. Strand, Orr, Minnesota.

Alarm Clock Operates Homemade Electric Time Switch

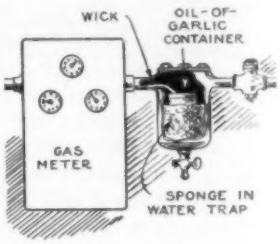
For turning on the electric current to an auto heater, or the like, at a predetermined time, a switch can be made from an old alarm clock, a few pieces of spring sheet brass, a wall socket, plug and extension cord. These are rigged up on a suitable wooden baseboard as shown in the drawing. The pieces of spring brass are screwed to a wooden block mounted vertically, the curved ends making contact with each other unless held apart by the piece of fiber. A length of cord is tied to the fiber and to the alarm key of the clock so that, when the key turns, the piece of fiber is pulled from its position between the spring contacts. This closes the circuit, and current is furnished at the point desired.



Time Switch in Which Alarm Clock Pulls Out Plug between Spring Contacts to Close Circuit

Odorizing Natural Gas for Safety

As natural gas is virtually odorless, a leak in the lines is extremely dangerous and has been the cause of many accidents. This condition may be remedied by odorizing the gas, which in one case was done by using oil of garlic. The cover of the water trap, which is connected in the gas line near the meter, was removed and a rubber sponge put in the trap, after which a small can, such as a shoe-polish can, was filled with oil of garlic. A hole was punched in the lid, a wick pulled through the hole, and the can was then set on the rubber sponge in the trap, tucking the extending wick a short distance into the gas line and then replacing the trap cover. The odor from the oil impregnates the gas, so that when a gas jet is opened and the gas not ignited, the smell distinctly advertises the fact. The burning gas has no odor.



Stiffening Shoelace Ends

Dipping shoelace ends in varnish, shellac or glue, rolling them between the thumb and forefinger and allowing them to dry thoroughly, protects them from fraying and forms a tough stub that makes an excellent substitute for the usual tinned cap. This method is especially useful when laces have to be cut to special lengths and the caps are lost or destroyed.

SHOP NOTES

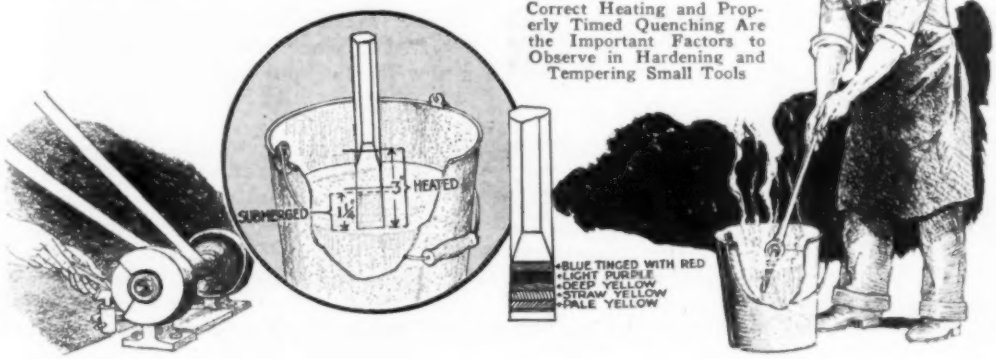
Hardening and Tempering Small Tools

By RUSSELL HAYS

ALTHOUGH the grinding of small bench tools, such as cold chisels, is an easy task for the average man, hardening and tempering them properly is not such a well-known procedure, but like so many things, it is relatively simple after one knows how.

After the point of the chisel or other tool has been roughly ground and sharpened, a 3-in. portion of the point is slowly heated to a dull red, but no further, as overheating of finished steel coarsens the grain and weakens it. About half of the heated portion is then plunged into the water, which hardens the steel. The time required to cool the point varies with the thickness of the steel, but usually is about 10 seconds. The tool should be moved back and forth in the water so that there is no definite dividing line between the cooled and the heated portion. If this is not done, the sudden change in temperature along a sharp line is likely to weaken the tool so that it will break when in use, perhaps at the first blow. Then take some emery paper and polish the point as quickly as possible, until it is bright.

Now comes the tempering. After removing the chisel from the water, the heated portion begins to diffuse its heat into the cooled point, and a series of colored bands, blending into each other, yet clearly discernible on the polished surface, seem to follow each other down toward the point. The hardened portion, that is barely touched by the oncoming heat, assumes a pale-yellow color. Just behind it lies a band of straw-yellow where the steel is slightly warmer, yet too brittle to be used as a bench tool. Following this comes a line of deeper yellow and indicates a steel quite a bit harder than a file, but not too brittle to be occasionally used on the tip of lathe tools. This band merges into a light purple band, where the steel has a hardness suitable for the cutting edge of chisels and most other bench tools. It is just the least bit softer than the teeth of a file and is tough enough not to chip. As the chisel cools, the colors move more slowly. When the blue-and-red band, which follows the light-purple one, nears the cutting edge, plunge the chisel into the pail of water just long enough to cool



Correct Heating and Properly Timed Quenching Are the Important Factors to Observe in Hardening and Tempering Small Tools

the entire tool, so that the hardness will not be run completely off the point. It takes only a second to stop the movement of the colors, and a few more dippings will gradually cool the tool. The tempered point is permanently fixed, while the rest of the tool is soft and pliable, and will not shatter under a blow.

To anneal or soften a piece of hard steel, heat to redness and allow it to cool gradually. Placing the piece in ashes beside the fire will cool it slowly enough. Thin knives cannot be tempered in the manner described, because water cools them too rapidly. Such work is usually done in oil and requires a great deal of care.

Adding a Square, Bevel and Rule to Your Handsaw

A Straight-Back Handsaw Can Be Improved by Equipping It with a Square, Bevel and Rule

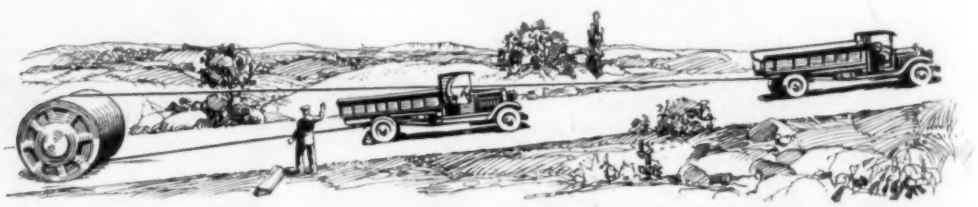
By adding a square, bevel and rule to a handsaw that has a blade with a straight upper edge, its usefulness will be greatly increased. Cut out suitable blocks to fit against the handle snugly on each side of the blade, as shown in the drawing. A side of one block is cut to be at right angles to the upper edge of the blade, while the corresponding side of the other block should be at 45° angle to the edge. Both blocks are drilled and counterbored for woodscrews with which they are attached to the handle. Rule graduations are carefully laid off on the edge of the blade with the aid of a sharp file, or they may be etched in the metal.

How to Preserve Animal Specimens Until Ready for Mounting

Museum workers have found that the best way to preserve a bird, squirrel or other animal specimen until it can be taken to a taxidermist, is to keep it submerged in water. The specimen is placed in a covered container filled with water and anchored in a running stream. This preserves the body better than if it were placed in a refrigerator.

Moving Heavy Circular Castings

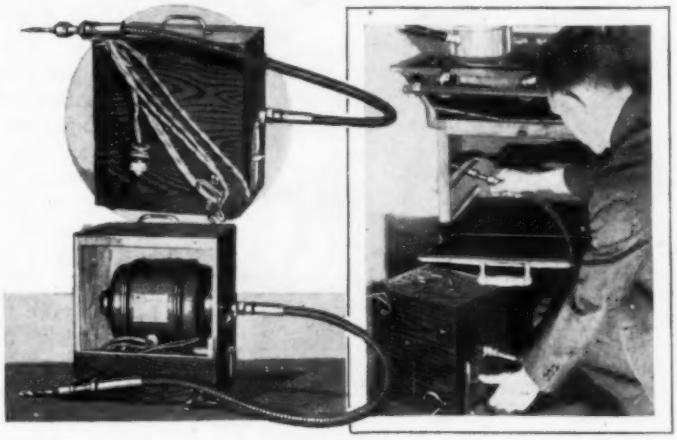
Large circular castings, which are often too heavy to be loaded on trucks and transported over roads in the usual manner, can be moved by the method shown in the drawing. A steel cable is passed around the casting, and the ends attached to two trucks. One truck, with brakes set and wheels blocked, remains stationary while the other moves ahead, rolling the casting forward. As the casting moves like a pulley it goes only half as fast as the truck and consequently requires only half the tractive effort that would otherwise be necessary. When the casting reaches the stationary truck, it is blocked in place and the trucks shifted to a new starting position.



Moving Large and Heavy Circular Castings with the Use of Two Trucks and a Length of Steel Cable

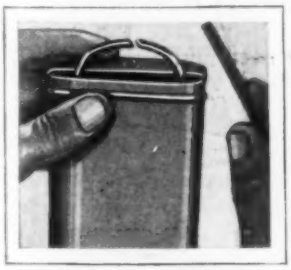
PORTABLE ELECTRIC DRILL HAS MANY USES

This electric tool chest, which furnishes power for small drills, grinders, buffers, etc., will be found useful by those who engage in general repair work. It consists of a ¼-hp. 110-volt motor which will operate on the house-lighting current. Any speed from 1,200 to 1,700 r.p.m. will be suitable for the purpose. A flexible shaft, which is attached to the motor, and a ¼-in. chuck can be obtained at any 25-cent to $1 store. Also get a flush-type toggle switch, a metal box to hold it, a switch plate, a length of lampcord, or other flexible double-conductor cable, and a plug. The motor is screwed to the bottom of a small wooden box, just large enough to hold it, a hole being drilled at one end for the shaft to project, and the switch installed where it will be handy to open and close, even with one's foot. A drawer pull provides a neat, sturdy handle, while two clothes hooks on the side are used for holding the extension cord, and a hook of galvanized-iron wire is slipped over the chuck when the outfit is not in use.



Repair Men Will Find Considerable Use for a Portable Electric Drill Equipped with a Flexible Shaft and Chuck

Tin Can Holds Ring for Filing



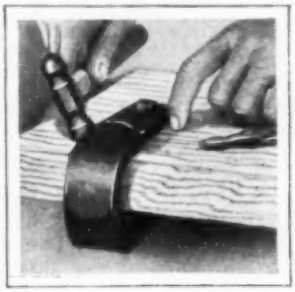
When it is necessary to file the ends of a piston ring to obtain the proper clearance, and the vise at hand is too heavy for the work, get a small tobacco tin of the kind shown in the photo. File or nick the edge of the lid in two places so that, when the ring is inserted as shown and the cover squeezed down, the ring will be held securely.

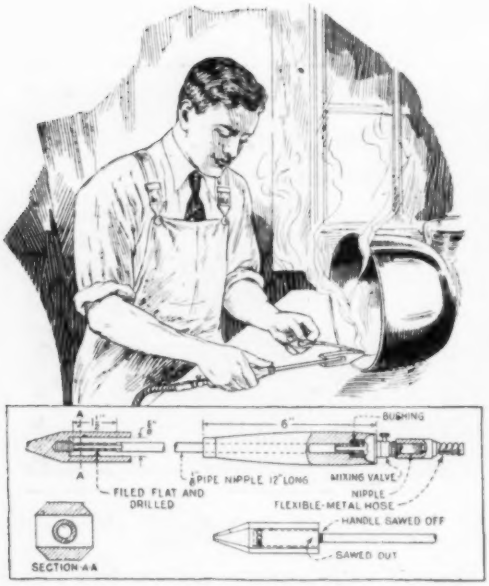
To Remove Carpet Stains

Grease stains can often be removed from carpets by first scraping off as much of the material as possible with a knife, then, applying a piece of heavy brown paper to the remaining spot, pass a hot iron over it repeatedly. Oil stains should be rubbed with a rag dipped in benzine. Sour milk is often effective in eradicating black ink after a thorough blotting. Lemon juice, followed by a sponging with warm soapy water, takes out red-ink marks on many carpets. If the stain is caused by tar, cover it with lard, remove as much as possible later with warm soapy water and, when dry, apply benzine.

Old Magnet Useful as Small Anvil for Workbench

An old magnet picked from the junk pile will be found handy as a small anvil when fastened to the workbench as shown. Drill a hole through one of its legs and through the bench top, and bolt the magnet down firmly.





This Homemade Soldering Iron, Operating on Gas, Is Handy for the Workshop

A Homemade Gas Soldering Iron

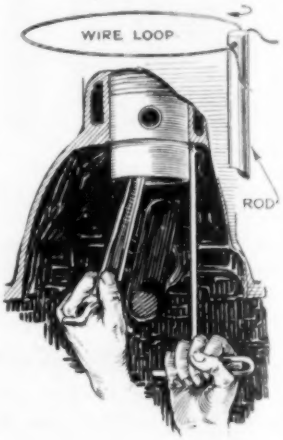
The gas-heated soldering iron illustrated will be found very useful about the shop or home. It is simple and inexpensive to make, all parts being readily obtainable. The copper head is cut out with a hacksaw and drilled as shown. A 1-lb. head will be found most suitable. The hole, into which the burner tube is screwed, is drilled about ½ in. deep with a 21/64-in. drill. The burner tube is a ⅛-in. pipe nipple, 12 in. long, already threaded at both ends. Flat surfaces are filed on one end of the tube, and burner holes are drilled as indicated. The other end of the tube is fitted with a mixing valve of the type used on inverted gas-mantle lamps. As the burner end of the valve is slightly larger than the tube, it will have to be bushed. The valve has a short ⅛-in. nipple screwed into the intake end. A length of flexible metal hose with rubber end connections is used to join the soldering iron to the gas supply. A large wooden handle, drilled lengthwise and with the large end hollowed out to fit over the mixing valve, completes the job. In using the iron, the mixing valve should be adjusted so that the gas will burn with a clear blue flame. The flame should not extend beyond the sides of the head.

Tooling Aluminum

For drilling aluminum, sharpen the drill as when cutting brass, but give it a sharper rake. This will cut fast and produce very little burr where it breaks through. Straight-fluted taps should not be used on aluminum, as they will not clear the chips as fast as a spiral-fluted tap. The speed with which the chips are cleared is important, as they spoil the threads when not removed immediately. A high speed and a light feed result in the best work. Lard oil and kerosene, mixed in equal parts, make the best lubricant for aluminum work. Many machinists find it difficult to get a smooth finish with the lathe tool, and resort to filing for a satin finish. This is unnecessary. When sharpening the cutting tool, give it plenty of back clearance so that the chips will not break off at once but will curl back and break, thus clearing the work and preventing mars. This also prevents the chips from building up on the tool and dulling it. If the same tool is used for both roughing and finishing, be sure to sharpen it before making the finishing cut.

Replacing Lower Piston Rings

Trouble often experienced in forcing the lower piston rings together when the piston is pushed back into the cylinder from below, has been eliminated by using the illustrated tool. A length of wire is formed into a loop, one end of which is fastened to the upper end of a rod, and the other end threaded through a hole. When the loose end is pulled, the loop contracts. In use, the loop is slipped over the lower ring and pulled tight to squeeze the ends of the ring together, after which it is an easy matter to push the piston into place.



Bending Wood at Home

by John E. Hyler

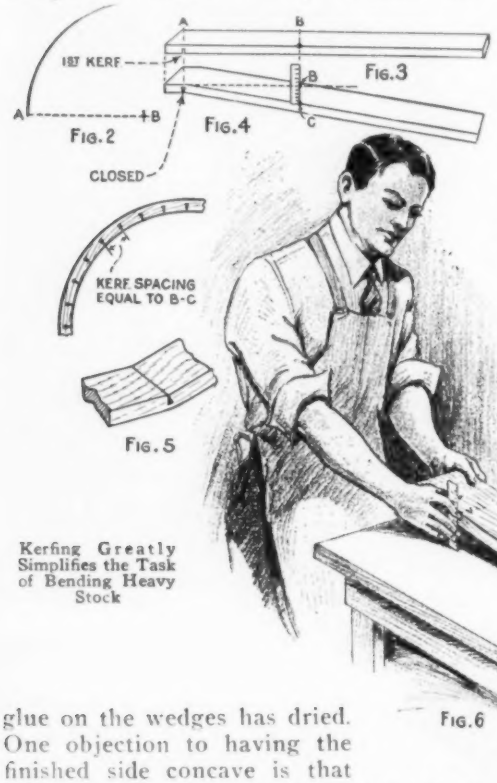
THERE are many cases where work, which is not very distinctive in itself, can be greatly improved by the addition of bent parts, some examples of which are shown here. A bent piece of wood, also, is much stronger than a curved piece that has been sawed out, as the former has no crossgrain. Wood cannot be stretched, and in this respect it is unlike most metals, which are usually ductile. Attempts to stretch wood invariably result in fracturing it. However, after bending a piece of wood, one side will naturally be longer than the other, and as stretching is impossible, it follows that the shortest side has either been compressed or part of it removed.

FIG. 1

Wood Can Be Made Pliable for Bending by Heating It in Boiling Water

In cases where the wood is too thick to permit bending it in the solid, "kerfing" is usually resorted to, especially on jobs that are not very particular and must be finished quickly. Kerfing is the process of making saw cuts across the back surface of the portion to be bent, as shown in Figs. 5 and 7, and then bending it to shape. This method is used where only one side of the work is to show. In bending wood by kerfing, the curve is first laid out on paper, as shown in Fig. 2, the distance AB representing the inside radius. The first kerf is cut a short distance from the end if the bend is to start here, as shown in Fig. 2, at point A, and its depth should be equal to about two-thirds of the thickness of the wood. Using this kerf as a starting point, mark off the distance AB, in Fig. 3, which is equal to the radius AB. Clamp the end of the piece to the bench top, as in Fig. 6, so that the kerf is on the upper side, and carefully raise the other end until the kerf closes. With a try-square or rule, measure the vertical distance between the points B and C, Fig. 4, which is the distance from the lower edge of the board to the bench top in Fig. 6. If the piece shows any inclination to splinter at the bend, the kerf must be cut a little deeper, and in this way the required depth of kerf can be found. The distance BC is the correct spacing for the kerfs along the entire inner surface of the portion to be bent, as shown in Fig. 5. Often this method of bending is used in making a bent riser for the bottom step of a stairway, platform riser or other similar purpose, and the step or floor serves to hold it in place. When a piece has to be bent so that the kerfs come on the outside or convex side, wedges are glued

in the kerfs to keep the wood apart. The piece must be handled carefully and should be bent around a form to which it can be clamped as shown in Fig. 7, until the glue on the wedges has dried. One objection to having the finished side concave is that faint vertical lines will show through at the location of the saw kerfs, but this can be partly overcome by scraping and sanding.



Kerfing Greatly Simplifies the Task of Bending Heavy Stock

Another method of bending wood over a permanent form is shown in Figs. 8 and 9. It consists of "backing a piece out," or recessing, and then bending it around the form. The portion to be bent is carefully backed out until only a thin part remains, as shown in Fig. 8. The job of recessing can be done by kerfing at intervals and then using a chisel and smoothing plane. The form is built up of blocks of wood, as shown in Fig. 9. After gluing the blocks together, they are cut to the desired curvature on a bandsaw, so that the outside will provide a smooth bearing for the bent piece. Notches are cut in the corners for the end of the thicker part to butt against, allowance being made for a pair of wedges to keep the assembly tight. The wedges are made up longer than necessary, and are glued and tapped in place, after which the projecting ends are cut off flush. A piece of sheet metal, bent around the outside as in Fig. 10, provides added insurance against breaking the wood.

Figs. 11 and 12 illustrate how wood can be bent in the solid, the degree of success depending on the kind of wood used. Hard close-grained woods do not bend readily, unless they are very tough. As a rule the more open-grained a piece of wood is, the easier it is to bend. Elm and hickory are two outstanding kinds of tough woods that can be bent well. Oak, ash, chestnut and walnut are good examples of open-grained woods with a fair degree of toughness, which makes them a good risk for bending. Mahogany will bend fairly well. Green wood will bend better than seasoned wood, but usually it is not suitable, as it cannot be finished well or expected to keep the same shape and size. Air-seasoned wood will bend much better than kiln-dried wood. To increase the bending properties of wood, it can either be steamed or soaked in boiling water. Where it is to be bent throughout its entire length, the first method is best, but if the bend is to be on one end only, the balance of the piece will hold its shape much better if only that end is immersed in boiling water, as shown in Fig. 1. It is

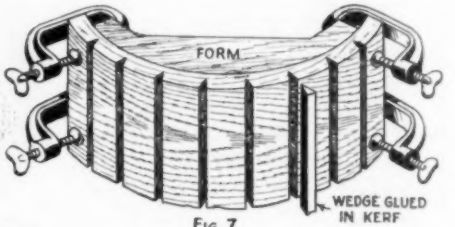


FIG.7

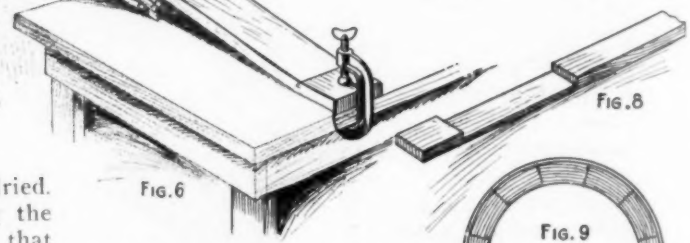


FIG.8

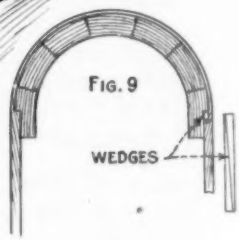
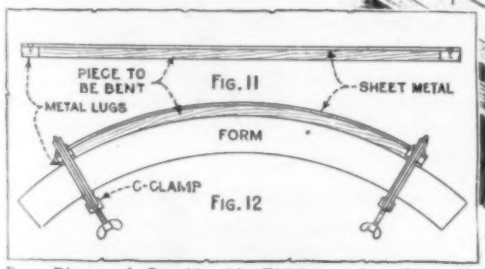


FIG.9

the heat rather than the moisture that makes the wood more pliable, but wet heat penetrates better and faster than dry heat. When bending wood in the solid, the outside surface tends to stretch, and to avoid this, pressure must be applied to the ends of the piece while making the bend. This can be done by using a strip of sheet metal, a little longer than the work so that metal lugs can be securely screwed onto the ends, as shown in Figs. 11 and 12. The work should fit snugly between the lugs. It is bent slowly and gently until it reaches the desired arc, after which it is clamped to a form and left there until it has dried out thoroughly. The sheet metal confines the wood, preventing it from stretching, while the lugs at the ends compress the inner surface. Never bend a piece suddenly, but always with a slow, gentle and positive motion.

Where both sides of a bent piece must be finished, there is only one other method known to the writer, which is practical without the use of very expensive bending equipment, and that is by laminating or building up the bent piece from a number of thin parts, either stock or veneer, as shown in Fig. 10. The sharper the bend, the thinner the individual pieces must be. Each one is coated with glue on both sides. In bending, the pieces will slip over each other while the glue is wet. After the glue has dried they will straighten out a little, and therefore one should make some allowance for this, say, ½ in. to each foot of radius. To get a radius of 2 ft., make the actual bend 23 in.



Bent Pieces of Considerable Thickness Are Often Built Up by Gluing Together Several Layers of Thin Stock

To hold the wood in position, a number of blocks or brackets, of the kind shown in Fig. 10, are nailed down to the floor or bench top along a line equal to the desired curve. The thickness of the material used will determine the spacing of the blocks. For very thin veneers they must be set as closely as possible. After the pieces have been coated with glue, they are set up against the brackets, paper being placed between the brackets and the work to prevent them from adhering in case the glue runs down between them, while a piece of sheet metal, cut to the same width as the wood, is placed along the outside. Casein glue, which is used cold, is best for a job like this, as one is not rushed in using it, for it does not chill. Start clamping in the middle of the assembly, and work both ways, putting on the end clamps last, the correct sequence being indicated by the numbers. In this way any irregularities are "ironed out" of the material as one goes along, and trouble from buckling is overcome. Be sure that the pieces are tightly squeezed up at each step before proceeding to the next, in order to prevent buckling. The glue must be allowed to dry thoroughly before removing the clamps. Do not apply too much glue as it will only squeeze out at the edges and cause trouble.

Holding Irregular-Shaped Pieces for Welding

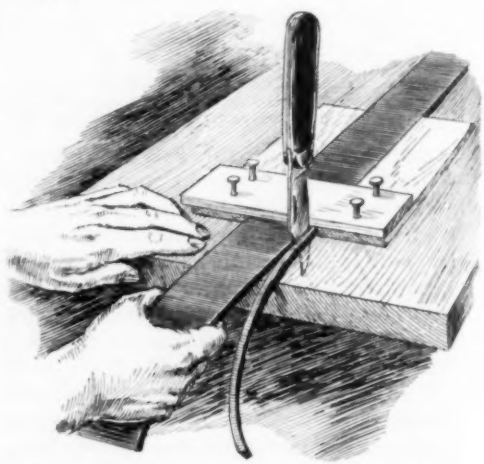
In the average small welding shop, where two jobs are seldom alike, the use of specially made jigs for holding the work is impractical. The usual method of supporting the work by means of fire bricks and wedges or lumps of carbon putty is not reliable, as the work often slips just as it is being finished, with the result that it must be done all over again. Besides, it requires more time to set up a job in this way than it does to make the weld. The use of sand as a supporting medium has been tried but not found satisfactory, as it flies about badly and also breaks down when subjected to the flame. A better material for the purpose is wood ashes. By first tamping the ashes firmly, the broken pieces to be welded can be pressed down in any desired position. That part of the ash which is struck by the flame blows away and the remainder becomes incandescent, aiding materially to bring the work to the proper temperature. Some of the ash may fuse onto the work but can easily be scraped or brushed off. Although the use of ashes was found quite satisfactory, a still better bed for supporting the work can be made from carbon rods of old dry cells. Crush the rods to the size of peas. Carbon does not break down even when subjected to direct flame, does not pop and crack or fly about. It becomes very hot next to the weld and holds the heat, thus preventing chilling. Tests have shown that, contrary to what might be supposed, no undue hardening takes place in the metal due to the absorption of carbon. Although any handy container can be used for holding the carbon, a revolving stand held by a discarded auto shaft and housing, the universal joint of which was poured full of babbitt to make it solid, was found highly convenient in one welding shop. The container consists of a metal disk and an old auto-wheel rim, the latter being held to the disk by means of three or four hooks. —C. R. Van Druff, McLouth, Kans.

Uses for Old Crankcase Oil

Old crankcase oil has many uses on the farm. It will kill weeds and grass, prevent rust on tools, protect paint on stored machinery, guard chicken houses against lice, lay dust and keep ants and other insects out of ice boxes.

This Jig Trims Belts Quickly

By tacking four pieces of wood of suitable size to a board clamped to the workbench, and driving the point of a sharp knife into the board as shown in the drawing, it is a simple matter to trim belts quickly and accurately. The two bottom pieces of the jig should be a trifle thicker than the belt and they are laid against the sides of the belt, while the third piece is tacked across them with a couple of nails at each end. The knife edge is set against the crosspiece at the point where it is desired to cut the belt, and is driven down firmly. In use, the belt is drawn through the jig as indicated.



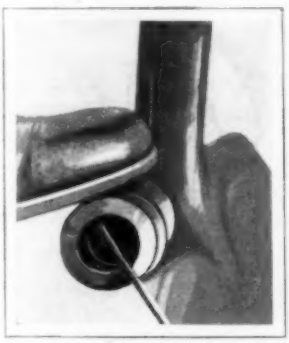
Belt Trimming Is a Simple Task With the Aid of This Improvised Jig

Nailing Ends of Hardwood Boards

When nailing close to the end of hard pine or other hardwood boards, it is almost impossible to avoid splitting the wood with the nails unless a brad awl is used to make a hole for them. In hardwood, it is difficult to push in a brad awl. It is much better to sharpen a nail as the awl is sharpened, and then drive it in and pull it out again. In order to avoid bending the nail when pulling it, as would be the case with a full-length nail, make them only a little longer than the thickness of the board, letting the head project so you can catch it in the hammer claw.

Lock Washers for Shovel Foot Pad

Almost any kind of shovel foot pad will come off and soon wears out, unless made of metal. An excellent pad can be made from a number of lock washers, driven over the top edge, side by side, as shown in the photo. Besides being comfortable, this pad will last the life of the shovel, and the washers, once driven on, will not come off.



Keeping a File Clean When Working Aluminum

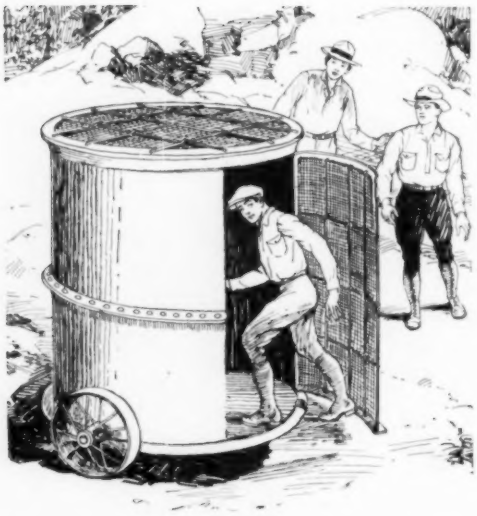
When filing aluminum, especially in cleaning up castings used for metal patterns, the filings soon fill up the teeth of the file and much time is spent in keeping the file clean enough to make a smooth cut. The trouble can be eliminated by coating the file with any of the various compounds used as a lubricant for tapping aluminum. The following preparation has been successfully used for this purpose: Gasoline, 70 per cent, beeswax, 15 per cent, and turpentine, 15 per cent. Apply this solution liberally to the file. Taps can also be cleaned of aluminum particles in the same way.—V. C. Darby, Cedar Rapids, Iowa.

Self-Closing Funnel on Printers' Ladle Is Handy for Filling Irregular Spaces in Forms

Improved Pouring Ladle for Printers

Printers using ordinary ladles for pouring metal in irregular spaces in advertising forms, will find the illustrated container much better, as the metal can be carried and poured with less risk of spilling it. It consists of a funnel fastened to a piece of flat iron which serves as a handle and is fitted with a wooden grip. A stopper for closing the lower end of the funnel is made from a rod slightly larger in diameter than the hole and tapered to fit the hole snugly so that the metal will not leak out. Two brackets, riveted to the handle, are drilled so that the rod makes a sliding fit in them, and a coil spring is slipped over the rod between the brackets. A finger hold for raising the stopper rod and heavy enough to hold a setscrew, is drilled to a sliding fit on the rod, the setscrew serving to lock it against the rod. The grip is pushed down against the spring, which is hooked over it and over the lower bracket. When the grip is pulled upward, the stopper is raised with it, and the metal runs out, while the stopper closes automatically as soon as the finger grip is released.—Jas. H. Rodgers, Toronto, Can.

¶Cheap brass tubing, made with a split down the side, is often difficult to cut; by inserting a round stick, large enough to fit inside of the tube tightly, the tube may be held in the vise easily.



Wheeled Metal Tank Provides Shelter against Flying Stones and Dirt Thrown by Dynamite Blasts

Shelter Tank for Dynamite Workers

In putting through an approach to a mine, a large metal tank, mounted on wheels, served as a shelter for the workers to protect them against flying stone and frozen earth thrown up by the surface blasts. A rectangular section of the side was cut out to afford an easy entrance, and a door, consisting of iron-bar framework covered with ¼-in. mesh, was hinged on one side of the opening. The open top was similarly covered with wire mesh.

Use for Old Auto Bodies

Filled with rocks to weight them, junked auto bodies were found useful in making a strong water wall in a swift mountain stream. As the rocks were retained in the bodies, it was impossible for the current to carry them downstream, and erosion of the banks has been practically eliminated.

Old Auto Bodies Lined on River Bank and Filled with Rocks Make a Strong Water Wall

To Drill Spongy Iron

Drilling a straight hole in spongy cast iron is often difficult, but can be done as follows: Take a piece of flat steel and drill a hole the same size as the one to be made in the iron. Clamp the piece of steel to the iron so that the hole will be directly over the spot to be drilled. If the hole is to be tapped, leave the steel piece on to serve as a guide during the tapping.

Improved Centering Plug

Instead of driving a wooden plug in a bored hole when it is necessary to scribe circles concentric with it, one mechanic finds it better to use a T-shaped wedge as shown in the illustration. A piece of ½ by ¾-in. wood is cut to fit the hole easily, after which another piece of the same stock is cut a trifle less than the radius of the hole. One nail is used to tack the end of the shorter piece to the center of the longer one, and the outer end of the short piece is rounded so that the assembly can be pushed into the hole sideways. A quarter twist on the short piece locks the wedge.

Smokeless Heater for Tool Kit

From a 1-qt. tin can, a cake of paraffin and some cotton or muslin rags, a small smokeless heater that can be carried in the tool kit, is easily made for a plumber or other workman who has to work in a cold room. The rags are cut into strips as wide as the depth of the can and rolled up tightly to fit in it. The paraffin is melted and poured over the rags which are then ignited. They will burn for several hours without producing smoke, and the heat will quickly raise the temperature to the comfort point.—Fred C. Wegener, Indianapolis, Ind.

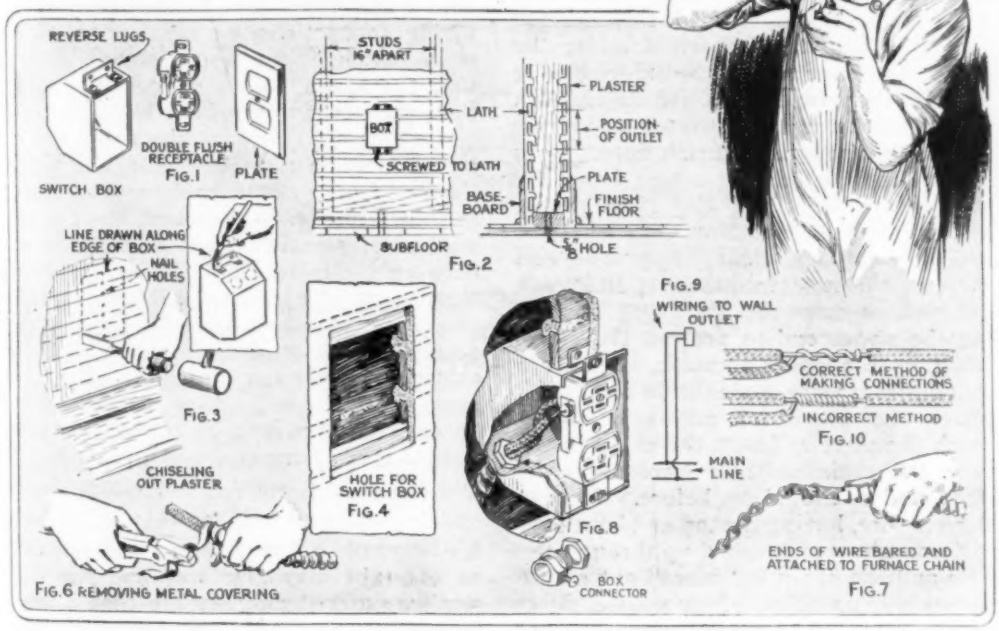
Wall Outlets Are Easy to Install

By E. R. HAAN

NEARLY every home owner needs extra wall outlets for connecting lamps and electrical appliances. The materials necessary for an outlet are a switch box, a single or double flush receptacle with a plate to match as shown in Fig. 1, a length of flexible-metal two-conductor cable, which will extend from the wall outlet to the nearest ceiling outlet in the basement, and two box connectors, used to attach the cable to the boxes. All of these parts can be obtained at any hardware store and often at 5 and 10-cent stores.

In this article only the installation of outlets on the first floor of a house will be considered. Pick out the location for the outlet, usually a few inches above the baseboard, and make sure that there is no beam or other obstruction running directly under the partition at the point where you intend to install the outlet. Drive a light finishing nail into the plaster a number of times in a vertical row, not covering more than 4 in., as shown in Fig. 3, to locate the exact position of the lath under the plaster. Then take the switch box and place it with the open side against the wall over the nail holes so that one lath will cross the center of the box. This lath is to be cut out entirely, while only portions of the two adjacent ones are to be removed. The proper location for the box is shown in Fig. 2. Draw a line along the edge of the box to outline it on the wall, and then cut along these lines with a sharp chisel or knife, proceeding with care to avoid breaking off the plaster and wallpaper outside of the portion marked off. After the plaster has been carefully removed, take a keyhole saw or a hacksaw blade to cut out the exposed portion of the center lath, and to make cuts into the adjacent laths to the edge of the plaster, after which the exposed wood is cut away. The box should now nearly fit

FIG. 5



in the hole with the lugs extending, although a little trimming may be necessary. Just enough plaster is cut away at the top and bottom so that the lugs will fit against the exposed portions of lath. The lugs must be adjusted, and perhaps reversed, so that, when they are pressed tightly against the lath, the edge of the box will

Soldering the Connections Is Important and Should Not Be Omitted for Any Reason

come flush with the surface of the plaster. After this, the box is set aside temporarily, and the opening in the wall appears as shown in Fig. 4.

Bringing the cable up through the partition is next. Take your auger and bore a ⅝-in. hole straight up through the center of the partition, right under the outlet, as shown in Fig. 5. Before boring the hole be sure to measure its location with precision as a slight error may result in a hole through the finish floor. Bore up through the subfloor, which forms the basement ceiling, and also through the plate of the partition. Now get a length of ordinary furnace chain, drop one end through the hole from above, and let it hang down into the basement, anchoring the upper end to prevent the entire chain from slipping through. In case a wall outlet is made more than a few inches above the baseboard and one cannot reach the plate to insert the chain in the hole, the chain must be lowered to the plate and anchored as before. Then a slender wire, having the top end bent over to form a hook, is pushed up through the hole and the chain is "fished" out of the partition from below. Remove the metal covering of the cable at both ends for about 6 in., Fig. 6, and bare the ends of the conductors about 2 in., after which the bared ends are hooked to the furnace chain as indicated in Fig. 7. Go upstairs again and pull up the chain, having someone feed the cable into the hole. When the end of the cable comes through the hole in the wall, remove the chain. Attach the clamp part of the connector to the end of the cable, slip it through a hole in the box, made by punching out a perforation, and screw the nut on the collar from the inside of the box. This fastens the box and cable together securely, as shown in Fig. 8. Small woodscrews are used to fasten the box to the lath. The bared ends of the cable are clamped under the terminal screws of the flush receptacle, which in turn is fastened to the switch box with the two small screws accompanying it, and the plate can be attached. The plate will cover the ragged edges of the plaster, if you have been careful not to chip too much away.

The last part of the job consists merely in connecting the other ends of the cable to the nearest ceiling outlet in the basement, or to the most convenient point in the basement circuit if the wiring is open. The diagram, Fig. 9, shows how the wires are connected. The end of the flexible conduit is also attached to a ceiling outlet with a box connector. When making the wiring connections, be sure to have the main switch of the house circuit off, so that there will be no danger of shock. Bare each conductor of the basement circuit for about 1½ in. at the point where the connection is to be made, and wrap the bared ends of the cable around them as shown in Fig. 10, following the correct method of permitting the solder to flow between the turns, which insures a good connection. All traces of rubber covering should be removed, and the bared ends scraped perfectly clean to make a good soldered connection possible. Apply a paste flux, solder, which is absolutely necessary, and cover with rubber tape and friction tape. Turn on the main switch and you will be able to get "juice".

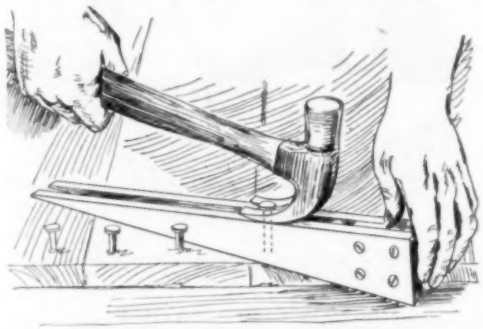
¶Always use a new tube in a new casing; an old tube may give way and the tire run flat, so reducing its life that a new tube would have been cheaper.

Rubber Hose Stops Thumping of Water Pump

Thumping of an automatic electric water pump, which is especially noticeable at night, can easily be eliminated by inserting a length of rubber hose in the supply line near the pressure tank. Cut out a section of the pipe about 12 in. long and substitute the hose, pushing it a couple of inches over the ends of the pipe. Use hose clamps for fastening the hose securely. The rubber expands when the pressure increases suddenly and thus eliminates the noise.—E. P. Smith, Turner Center, Me.

Split Wedge Helps Pulling Nails

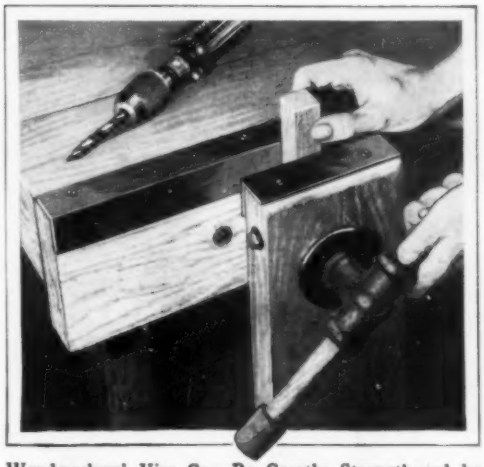
A heavy nail may be drawn a short distance with a light hammer without breaking the handle, but drawing it further may cause a break. If a block is set under the head to raise the claw, the risk is lessened, but a block of the right height isn't always at hand. A split wedge, as shown in the drawing, can be kept in the tool box for this purpose. It is made from two pieces of ½-in. hardwood, preferably



For Pulling Heavy Nails, This Split Wedge is a Handy Addition to Your Tool Kit

maple, about 14 or 15 in. long and tapering from 2 in. at one end to a point as indicated. Bolt or screw the pieces together at the wide ends, with a 3/16-in. piece of wood between them. In use, the wedge is inserted between the work and the hammer with the nail in the slot, and as the nail is pulled out the wedge is slipped up.—W. F. Willis, Los Angeles, Calif.

¶Worn ball bearings can be repaired by truing up the races and substituting larger balls for the worn ones.



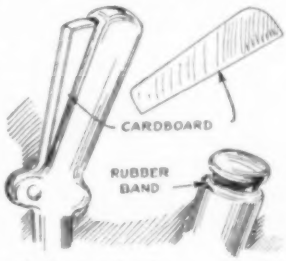
Woodworkers' Vise Can Be Greatly Strengthened by Fitting It with Angle-Iron Jaws

Angle-Iron Jaws Strengthen Woodworkers' Vise

By providing an ordinary woodworkers' vise with angle-iron jaws, its life will be greatly increased, and the piece on the bench edge may be extended several feet to provide a solid edge that can be used as a light anvil for shaping sheet metal, wire, etc. You can recess the wood so that the angle-iron will come flush with the surface of the bench, or it may be left to project above the surface to serve as a bench stop for planing. Drill and countersink the iron and use flat-head screws, which will come flush with the surface. Projecting screws would, of course, be sure to mar the wood that is held between the jaws.

Silencing Brake-Lever Rattles

If the emergency brake lever in the model-A Ford develops a rattle, the noise can often be stopped by inserting a piece of thin cardboard on each side of the catch and shellacking it on one side next to the handle. A rubber band or a drop or two of solder will also correct the trouble in case the button on top of the brake lever should begin to rattle.



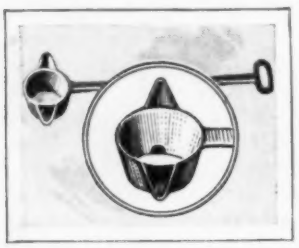
Paste Table Fitted with a Roller for Holding the Paper Makes Work Easier and Saves Time

Improved Paste Table for Paperhangers

Paperhangers can handle wallpaper much easier by using a holder for the roll at the end of the paste table as shown. The fixture consists of a frame made of flat iron with the ends bent over at right angles and drilled to take a wooden roller of the proper length. The whole is screwed to the underside of the table top. The provision of two strips of wood along the sides, spaced apart so that a standard width of wallpaper will fit between them, was found convenient for pasting, as there is no risk of getting the paste on the face side. The small amount of paste that gets on the edge of the strips can easily be wiped off before coating the next piece.—C. L. Sample, Augusta, Ga.

Improving the Babbitt Ladle

This babbitt ladle has a long handle and two spouts which are fed through holes in the side near the bottom as shown. This arrangement makes it possible to pour metal that is entirely free from slag. The spouts were made of ⅛-in. sheet steel, heated and forged to shape, after which they were welded to the cup. Another advantage of this ladle is that the risk of spilling is greatly reduced, and consequently also the danger of injury.



Sheet-Metal Disks Cut in Vise

Sheet-metal disks, can be cut without any other tools than a vise, cold chisel and a hammer. A hole is drilled in the metal to fit a rod, which is held vertically in the vise, serving as a center on which the work swings. Similarly, a cold chisel with a sharp cutting edge is clamped between the jaws so that the cutting edge just projects. If the diameter of both rod and chisel are the same, they will be held equally tight, but if the rod is smaller, a piece of wood is used to block it up. The distance from the center of the rod to the chisel edge should be equal to the radius of the desired disk. In use, the piece of sheet metal is moved over the cutting edge and tapped lightly with a mallet.

Vise, Hammer and Cold Chisel Are the Only Tools Required for Cutting Neat Sheet-Metal Disks

Lacing Belts with Rawhide

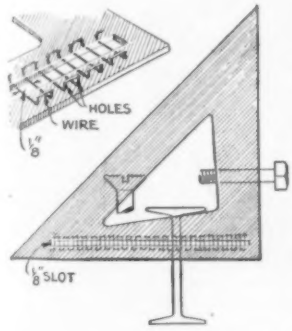
Lacing belts with rawhide strings can be made much easier by holding the tips of the rawhide lace over the flame of a match. The fire hardens the leather and forms a stiff point that is easily inserted into the holes in the belt.—A. C. Wilson, Columbia Cross Roads, Pa.

Cleaning Shellac Brushes

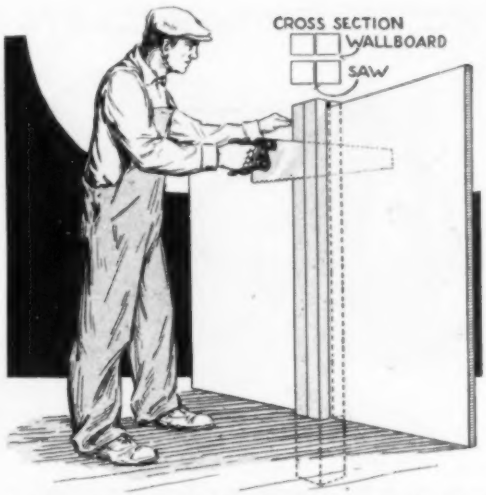
The proper way to clean a shellac brush is to use alcohol liberally. A tomato or soup can, suiting the size of the brush, is the best container. With enough alcohol to nearly submerge the brush press the bristles forcibly sidewise on the bottom of the container, first one side then the other, time and again. After most of the shellac has been removed repeat the process, using clean alcohol. It may even be necessary to use a third portion to get the brush perfectly clean. Then free the brush from the liquid by shaking it, and wipe with a rag. Don't throw the alcohol away, but put it away in a bottle. After it clears and the shellac settles to the bottom it can be used again. In this way there is no waste. Much trouble can be avoided if the brush is cleaned at once after a job is finished. If a shellac brush is dry and hard, set it in alcohol for several days, covering the can to prevent evaporation. The writer has a brush used for shellac only for more than 10 years, and it is still soft and as good as ever.—C. D. Cheney, Lyndhurst, N. J.

Improving the Draftsman's Triangle

Draftsmen's triangles can be trimmed down so that the inside edges give the proper angles for laying out screw heads, threads on screws and bolts, sections of I-beams, and anything else in which the angles used are more or less standard. Another idea that has been found useful, is a slot in the lower section of the triangle with small holes drilled on each side, these being spaced equidistantly and laced with thin copper wire as shown. This provides a quick method of making uniform dotted lines.—G. Burrows, No. Tonawanda, N. Y.



¶When out of cast-iron flux or scaling compound for welding, fine table salt makes a good substitute.



A Convenient Saw Guide That Will Save You Time in Cutting Through Wallboard

A Saw Guide for Cutting Wallboard

For cutting wallboard quickly, the illustrated guide will be found helpful. It consists of two 5-ft. lengths of 2 by 6-in. stock, nailed together at one end with a 10-in. piece of ½-in. stock between to serve as a spacer so that the wallboard can be slipped between. A saw slit is made through the center, and the guide is erected as indicated.—Robert Paulson, Hutchinson, Minn.

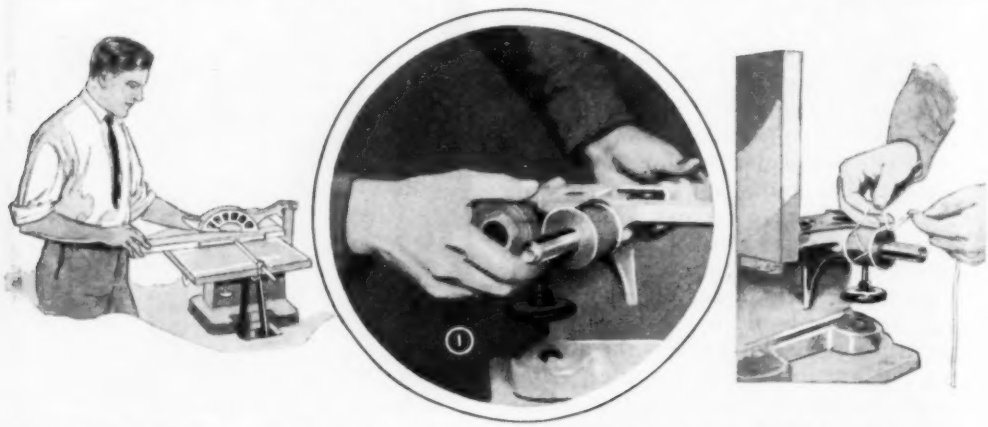
Finding Cracks in Metal

Surface cracks in small metal articles can be detected by cleaning the articles in a hot soda solution and immersing them, while warm, in kerosene. They are then wiped dry and coated with whitewash. After this is dry, the article is struck several blows with a hammer. If there are any cracks, the kerosene in them will ooze out and show up on the whitewashed surface. If the objects are too large to be immersed, wash them with the soda and proceed as before.

Kerosene-Soaked Magazines Used for Kindling

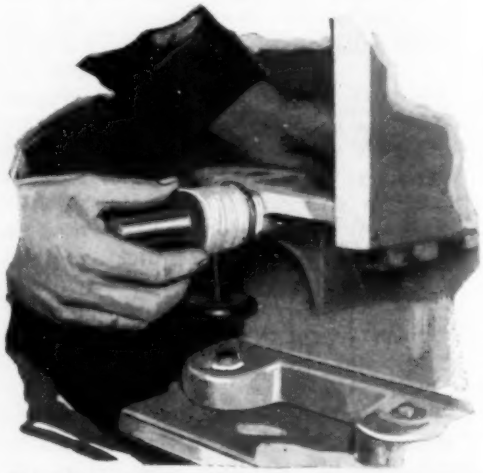
Discarded magazines, wrapped into tight rolls and bound with wire, make satisfactory kindling when soaked in kerosene. The roll is safer to use than loose paper and burns longer, forming a good substitute for wood in starting a fire.

HOW SLIPPING PULLEYS CAN BE CURED BY LAGGING



Although Not Intended as a Permanent Remedy for Slipping Pulleys, This Method of Lagging Will Last a Long Time, and the Wrapping Can Be Removed or Renewed in a Few Moments

Cast-iron pulleys keyed to the shaft of small bench saws, often give trouble owing to the surface being worn smooth by the belt. Belt dressing is of little or no avail, and a stiff tension on the belt is usually considered the only alternative cure. However, this results in excessive wear on the light bearings in both the saw and the motor, and is therefore not desirable. Belt slippage on small iron pulleys can best be remedied by lagging, or wrapping the surface with something to increase its friction. To do a satisfactory job, one cannot stop by merely winding the pulley with thread in crisscross fashion, spreading glue on the thread, although this method has been found serviceable for a short time under light load. But when taking a heavy ripping cut with a ½-hp. motor, the thread will let go entirely or will break and wind up in the bearing. After experimenting with several other methods, the illustrated wrapping was found strong enough for any strain likely to be applied to the saw. The pulley is first wound with a layer of friction tape, the wrapping being started at one side with only the edges overlapping slightly. Be sure to wind it as tightly as possible without tearing. On the average flanged pulley only a single-layer wrapping is advisable, because, after the thread has been wound on, the lagging will be so bulky that the flanges will not hold the belt in place under a heavy load. Thread a strand of cobblers' thread through a fairly heavy sewing needle, double it and tie the ends together after which the thread is thoroughly waxed. Begin at one side of the pulley and stitch through the tape, back and forth from one side to the other so that the strands cross the pulley diagonally, as shown in the right-hand detail. Pull the thread fairly tight, but not so tight that it will draw the tape loose. Continue the stitching all the way around the pulley. Pass another length of thread through the needle, doubling and tying again in the same way. Wax the thread and start winding at one side of the pulley, taking a halfhitch of the thread over every second one of the cross stitches.



The Thread Will Not Unravel As It Is Tied to Cross Strands Stitched to Tape

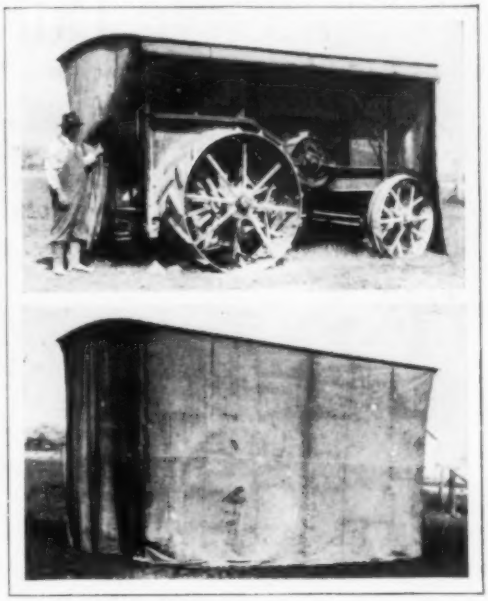
Keep the strands close together but separate, so that they will not be doubled, and be sure to keep them drawn tight. Continue the winding in this way, halfhitching each winding to the cross stitches until the pulley face has been entirely covered. Then sew the end of the thread into the lagging in several places so that it will not loosen. After this has been done, the lagged surface is given at least two coats of shellac. When thoroughly dry, put on the belt and start the motor. Do not put the pulley under a load immediately, but allow it to run idle for a short time and give the belt one or two applications of dressing. This will collect on the lagging and serve to level the strands of thread, besides providing more friction. The cross stitching prevents the thread from unwinding as soon as one or two strands break. In this way, fraying thread will be held in place until the lagging is virtually worn out. While not a permanent remedy, this method will effectively prevent slipping, and it takes but a few minutes to renew or remove the lagging when necessary.

Electric Fan Settles Liquid in Thermometer

When the column of liquid in a thermometer is separated, and it cannot be shaken down, attach the thermometer to the blades of an electric fan as shown, using strong rubber bands to hold it in place. Be sure to get all the liquid of the thermometer on one side of the center of the fan so that when the latter is run at low speed for a few minutes, the liquid will all be forced toward the bulb. Thermometers should always be hung in a vertical position even when not in use, so that the column of liquid will not be broken.—Dr. Ford. Carpenter, Los Angeles, Calif.

¶ The ends of a revolving shaft should be inclosed to avoid accidents.

Portable Canvas Garage for Tractor



Canvas Garage for Tractor Protects It against the Weather When Left Outdoors

As he was often obliged to leave his tractor out in the field on a job that required several days, a western farmer built a portable garage of canvas to protect the tractor against the weather. A permanent roof was provided and the canvas suspended from the sides. When the tractor is to be used, the sides are rolled up and fastened to the top with straps. The upper edge of the canvas was attached to the roof by means of 1 by 2-in. strips securely bolted to the roof and sewed to the canvas. Any shoe repairman will do the job of sewing the strips to the canvas. Suitable grommets should be provided in the vertical edges of the canvas so that adjacent sides can be securely laced together to prevent them from being blown apart in a storm.

A Cardboard Drill Holder

A piece of corrugated cardboard, tacked to the side of a shouldered block of wood, makes a satisfactory holder for small drills. A narrow strip along the top is torn away so that the divisions for the drills may be seen more easily. Several applications of shellac make the paper durable.

Distinctive Dutch Colonial House

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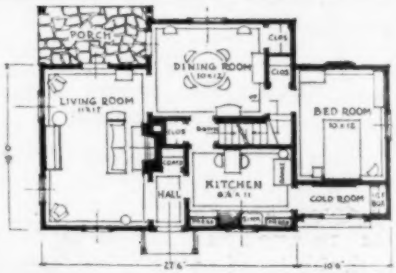

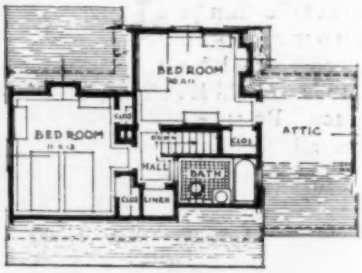

HERE is another plan that has the wanted flexibility of everything on the first floor for the first, and more rooms on the second floor when needed. After the house is completed, that first-story bedroom will be a source of comfort and convenience that practically every one will cherish.

But you can leave that whole wing off. If your lot is only forty feet wide, that will be the thing to do. Then the house becomes a five-room type complete in itself.

Some folks wonder why we left off the usual dormers in the front roof. That was not accident; it was planned. The idea is to get the true Dutch flavor—a broad expanse of unbroken roof designed with a graceful curve at the eaves. Such roofs on old houses of the Dutch period are extremely beautiful. As a matter of fact, dormers could only add needlessly to the expense, for each of the bedrooms is cross-ventilated and the bath has adequate lighting. There is planned convenience at every turn. Plans for small homes fit or misfit. All depends on the family needs and what can be afforded. This one is not costly. Whether or not it suits your family depends on personal taste.

The Architects' Small House Service Bureau of the United States, Inc., was formed to furnish a complete and dependable small-house plan service at moderate cost. For information regarding the blueprints and specifications address the bureau at 1200 Second avenue, South, in Minneapolis, Minn., from which also a booklet, containing twenty-seven selected small-house plans, may be had for the price of 10 cents. The bureau is under the control of the American Institute of Architects.